

A MONOGRAPH
ON
DYES AND DYEING
IN THE
BOMBAY PRESIDENCY

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The cloth, after being *alumed*, generally undergoes washing, by which the excess of tannin and soluble salts left by the decomposition of alum are removed, and the cloth is then ready for dyeing. This is almost invariably effected by immersing it in a solution of the dye in cold or hot water, until all the colouring matter has been absorbed or the desired shade obtained. After this all that is really necessary is to wash the cloth in clean water and dry it; but before being sent to market it is generally "finished," i.e., starched and calendered.

Those are the main principles on which the preparation of the cloth and subsequent stages of dyeing are carried out by native dyers in India, but the exact methods followed, being founded on the varying experience of their ancestors or on guess-work with little or no chemical knowledge, may be said to vary in details in every district and almost in every village in the Presidency. The chief variations are in the washing and dunging processes and the time taken over the different stages. As a rule, it may be said that it takes generally from a fortnight to three weeks to dye a piece of cloth with a fast colour, and even this is an improvement on the older methods, in which the different operations involved in dyeing a piece of cloth would occupy about three months. It is of course out of question for the native dyer to approach in any way the speed with which fabrics and yarn are now treated and dyed by the aid of elaborate machinery, and if he is ever to be able to dye goods within anything like a reasonable time, the adoption by him of some sort of modern drying machinery which will render him independent of the sun's rays for that purpose seems essential. Not only is it impossible to dry dyed goods within any reasonable time by simple exposure to the sun's rays, but also the varying conditions of the atmosphere cause a troublesome uncertainty as to the result.

Leaving this however aside, the following description of the ordinary process followed in dyeing a piece of cotton cloth may be taken as of fairly general application, being the result of a comparison of all the methods reported from the various districts.

(1) The cloth is soaked in a solution of water and fresh dung. In the Bombay Presidency proper, sheep's or goats' dung is generally used, in Sind camel or cow dung. In some places, e.g., Khándesh District, the cloths are soaked in *khunds* or *pacca* built pits, which are the common property of the caste. In other places the cloth is soaked in the dyer's own utensils at his house. In Sind potash is often added to the dung solution. The cloth is generally kept in this solution for one night.

(2) Next morning the cloth is taken out and washed with clean water at the river, if there be one, or other convenient spot, being rinsed and splashed upon a stone, &c., so as to remove as much as possible of the sizing. It is then spread out to dry and in order to sun-bleach it water is sprinkled over the cloth at short intervals until about 4 P.M., when it is finally washed and dried.

In some places, e.g., Karáchi, the stages (1) and (2) are repeated, and in Sind the cloth next undergoes a steaming process which does not appear to be practised elsewhere in the Presidency. This is effected in an ordinary *khumb* or washerman's steaming basin. In Karáchi the cloth is thus steamed for one night, and in Thar and Párkar for two days continuously. It is then taken out, washed and spread out to partially dry.

(3) The cloth is next soaked in a mixture of water, oil and alkali. The oil generally used is castor oil or gingelly (til) oil, for which in Sind mustard oil and oil of *jhambo* (*Eruca sativa*) are sometimes substituted. The alkali used is, as a rule, the impure carbonate of soda known as *sajekhar* or *papaikhar*. The former, which is obtained from burning salt wort and other plants and comes chiefly from the Arabian

coast, Persia and Sind, contains about 40 per cent. of impurities, chiefly carbonaceous matter, sulphurates, lime and iron. The latter is dug up from the bottom of small lakes or ponds in Sind, and the impurities which it contains consist chiefly of silica, chlorides and sulphurates. In Dhárwar Fuller's earth is sometimes substituted and in Sind potash is also used. In a few places dung is added to this mixture.

Rinsing and drying.

(4) The cloth is taken out, rinsed by being trodden down or splashed on a stone or board, and then spread out to dry.

The process (3) and (4) is repeated for several days, varying in number in different localities, but generally ranging from 3 or 4 up to 6 or 7. As a rule the cloth is steeped in the solution for the whole night and dried next day, but in some places, e.g., Surat, it is kept in the solution for some time, then taken out, rinsed and dried twice daily. In Bijápur the wet cloth, after having been steeped in the mixture, is kept folded up for one day, and in order to keep it moist, some of the mixture is sprinkled over it, while occasionally it is also dried in the sun. This process has to be repeated seventeen times.

(5) The cloth is washed in clean water, but not so thoroughly as to remove the whole of the oil, and finally dried in the sun.

Washing.

(6) Next comes the *galling*. The cloth is well soaked in a solution of powdered *hirdas* or myrobalans (fruit of *Terminalia chobula*). In some districts such as Kaira and Ahmedabad, *behdas* (fruit of *Terminalia bellerica*) are now chiefly used instead of *hirdas*, being cheaper. In Sind the solution is ordinarily made of powdered tamarisk galls,* oil and water. The period during which the cloth is kept in the mixture varies in different places. In Karáchi it is kept, for instance, from 1 to 3 days, while in most other places the cloth is simply well soaked in the mixture for a short time. It thus assumes a yellowish tint.

Galling.

(7) The cloth is next wrung out and dried. In some places, e.g. Bijápur, the cloth is occasionally moistened with some of the *hirda* solution while drying.

Drying.

(8) The cloth is now *mordanted* by being dipped in a solution of alum and water, to which in some places gum or a paste of tamarind seeds is added to make it sticky. In parts of Sind, Fuller's earth is also used by some dyers.

Mordanting.

(9) The cloth is now ready for dyeing and is generally boiled with a solution of the dye until all the colouring matter has been absorbed by the cloth.

Dyeing.

(10) In some places, e.g., Broach, Kaira, Násik, and Thar and Pákar, the cloth is then soaked in dung for one night.

Further dunging.

(11) It is next washed and spread out to dry gradually in the sun, water being sprinkled at intervals over the cloth, so as to brighten the colours. This process generally continues for four successive days, two days being given to each side.

Drying.

(12) If required, the cloth is finally starched by being dipped in a thin paste of rice or wheat flour, or in a solution of babul gum, and then dried. In Ahmedabad cloths intended for exportation to Siam are described as being 'polished' before being put on the market; and a similar process of polishing and calendering is an important feature of the preparation in the Bombay *Khatrí* factories of the indigo-dyed cloths exported to Zanzibar and Mozambique.

* These are more easily obtainable than myrobalans, the tamarisk tree being very common in Sind.

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DYES AND DYEING

IN THE

BOMBAY PRESIDENCY.

I.—General Account of the Dyeing Industry.

In its broadest sense, *dyeing* is the operation or series of operations by means of which uniform colour, of a more or less permanent character, is produced on or in the substance of objects. The term *tinting* is literally the same as dyeing, but is in its meaning only applied to the production of very light or delicate shades. In *printing*, the colour is applied to portions only of the material, and in such a manner as to produce a definite pattern.

The art of dyeing in Western India appears to have had its origin in Sind, where it still forms a considerable industry. This may have been due to its position, which gave it natural advantages in communication with the early civilized nations such as Assyrians, Egyptians, Babylonians and Persians, amongst whom the art reached a high pitch of excellence. On the other hand, it is said* that the Egyptians themselves borrowed the art from India, where it appears to have subsisted for more than 2,000 years. Probably the presence in an easily accessible form of alum and carbonate of soda, which play so large a part in the operation of dyeing in this country, has also something to do with the early introduction of this art in Sind.

Dyeing and calico-printing as practised in India is, as a rule, an hereditary occupation, in which the processes followed have been handed down from father to son, with but little variation or improvement. Only in the bigger centres a few capitalists exist who employ workmen dyers on a small scale; generally each family works entirely on its own account, and only in the particular branch of the occupation carried on by the caste to which it belongs. Thus there are separate yarn-dyers, silk-dyers, indigo-dyers, turtan-dyers, &c. The main business is, however, that of dyeing and printing cotton

Cotton dyers and printers. yarn and cloth for wearing apparel, carpets, curtains and bed clothing. In the census of 1891 cotton printers and dyers are returned as numbering 43,033 distributed as follows:—

Gujarát	...	...	...	...	14,936
Konkan	...	...	...	...	513
Deccan	...	...	...	...	6,709
Karnátak	...	...	...	...	1,198
Sind ...	...	...	...	...	12,938
Bombay City	...	...	...	...	3,789
Total ...					43,033

Further particulars are shown in Appendix I.

Cotton dyeing is so often combined with other occupations that these figures must fall very far below the real number of those who wholly or partly earn their livelihood by this avocation. There are, however, several distinctive castes whose main business is that of dyeing and printing, and the following general account of them may be of interest.

In Gujarát those who follow this occupation belong for the most part either to the *Bhavsar* or *Chipa* caste. The former are properly speaking a sub-division of the general *Rangari* or Dyer caste. According to the census of 1891 they number 21,065, of which 21,865 hail from Gujarát. From Gujarát some of them have come and settled in Bombay, Khándesh, Poona, Sholápur, Bijápur and Dhárwár. All

* Bancroft on 'Permanent Colours.' See Crooke's Practical Hand-book to Dyeing and Calico printing (1874), p. 3.

they claim to be people of Kshatriya or Rajput origin, who adopted their profession of dyeing to escape extermination at the hands of Parshuram, the sixth incarnation of Vishnu. In Sind the caste is known

Sind *Khatris* and *Khatris*. as *Khatiri* or *Khati*, and numbers according to the last census 3,156, of whom 945 are Mussalmans and the rest Hindus. These latter worship all the ordinary Hindu gods and goddesses, but hold the goddess 'Devi' in special reverence. Like the *Bhavsars*, they allow widow-remarriage. *Khatris* engage in cotton cloth dyeing and printing, cotton and silk yarn dyeing, especially the latter, which in some cases, as in Káthiáwár and Ahmedabad, they dye by the peculiar process called *knot-dyeing*, and in Cutch, Ahmedabad, Bombay and some other places, indigo-dyeing. In Thána there is an interesting body of *Khatris*, who are Catholic or Portuguese Native Christians, employed in silk weaving and dyeing.

Thána *Khatris*. These believe that they were Mussalmans before the Portuguese made them Christians; but it seems on the whole probable that they were originally some of the Hindu *Khatris* of Gujarát, who were subsequently converted to Mahomedanism.

In the Karnátak only 592 *Khatris* are returned at the census, of which 540 are from Bijápur and the remainder from Dhárwár; but

Patregars or *Patrekars*. the *Patvegars* or *Patvekars*, nearly all of whom come from the three Collectorates of Belgaum, Dhárwár and Bijápur, would seem to be originally a sub-division of the *Khatiri* caste. There is no doubt that they have come from Gujarát and their home tongue is Gujarati with a certain admixture of Maratha and Mussalman words. Like the *Khatris* they claim to be Kshatriyas, and their chief divinity is the goddess Ambabai at Tuljápur in the Nizam's country, as they believe her to be an incarnation of their patroness, the goddess Tulja, who is said to have saved them from the destructive axe of the Kshatriya-slaying Parshuram. Their hereditary calling is said to be that of dyeing silk in five different colours, and they are still the chief silk-dyers in the Karnátak. Many have, however, taken to silk and cotton weaving and other trades, such as those of silk fringe and tassel makers, or gold and silver thread makers. Their name is variously derived from *patavne*, to string silk thread on wire, and from their making the silk bands or *patas*, which women formerly wore to keep the robe tight. They are returned as numbering 2,724 at the last census, of whom 1,498 come from Dhárwár. Out of these 115 were Mussalmans, who ascribe their conversion to Aurangzobe, and like the Mussalman *Khatris* and *Rangrezes* are Sunnis of the Hanafi school. The *Patolis* in Sind,

Patolis. who dye raw silk and are both Hindus and Mussalmans, would seem to correspond to the *Patregars*.

Another caste in the Karnátak which has taken to dyeing is that of the *Lingayat Nagliks*. These according to the census of 1891 number 7,226, of whom the great majority come from Belgaum, Dhárwár and Bijápur. They are said to be a division of *Shimpis*, who have given up the business of sewing for that of dyeing cotton yarn and preparing it for weavers; but many of them are engaged in agriculture, and they are accordingly included among landholders in the census returns. The *Nagliks* are also called *Bandhgars* or *Banagars* from their generally dyeing cotton thread red in contradistinction to the *Lingayat Nilgars*, who dye it blue and black with indigo; but now the *Bandhgars* also use indigo in dyeing yarn.

As mentioned above, however, indigo-dyeing is generally quite a distinct branch of dyeing, to which certain castes, as a rule, entirely devote themselves. Indigo-dyers are mostly, though it is by no means an universal rule, Mahomedans. This may be to some extent due to the religious prejudice apparently entertained in some places by Hindus against indigo. Thus in Hyderabad (Sind) it is reported that Hindus will not work in indigo, nor will they wear clothes dyed with it. A similar prejudice exists in Sholápur, where the ordinary *Rangaris* do not dye black, and look down on and refuse to touch any one who does so.

In Ahmedabad and Bombay the indigo-dyers are all *Khatris*, of whom, certainly in the latter city, most, if not all, are Mussalmans. In Broach and Surat indigo-dyeing is mainly

Khatris

are Hindus, with the exception of 456 Mussalmans and 5,152 Jains. In Khándesh there are reported to be two divisions of the caste, the one called *Karmi* and the other *Dharmi*. Both are Hindus, but the latter have a Mahomedan *Guru* for their priest.

The *Chipas** take their name from the calico-printing done by them.

Chipas.

According to the census they number 2,617, almost all being Hindus of Gujarát, but it is doubtful whether this includes a large number of Mahomedans, mainly from Márwár, who are generally known by this name also. In Ahmedabad City there are said to be about 200 dyeing and printing establishments belonging to Mahomedan *Chipas*, each employing from 5 to 40 men. They are more skilful workmen than the *Bhavsars*, and the latter have accordingly suffered considerably of late years by the stress of competition, being reduced to only four establishments, though there are some 700 houses belonging to members of that caste.

In the Deccan, cotton-printers and dyers are generally known as *Rangaris* if Hindus, and *Rangrezes* or *Rangaris* if Mahomedans. The latter are not many, and are mainly either immigrants from Márwár or Hindus forcibly converted during the time of Aurangzebe. At the census of 1891 there were 12,516 persons returned as *Rangaris*: of these 9,476 came from the Deccan, chiefly from Khándesh, and 2,616 from the Karnátak, principally Dhárwár and Bijápur. In the Deccan they do not differ from ordinary Maráthas in house, food or dress, and their family gods are Bahiroba, Khandoba and Vithoba. Many of the *Rangaris* are, however, really *Bhavsars*, like those at Málegaon in Násik, who are said to have come from Pátan in Gujarát some three or four generations back. Again, many dyers belonging to other castes are commonly styled *Rangaris* from the nature of their occupation.

Rangaris, however, do not confine themselves to cotton cloth dyeing and calico-printing, but in most places are also yarn-dyers and silk-dyers. The *Rangrezes* would seem to devote themselves chiefly to turban-dyeing.

Another large caste of dyers are the *Khatris*, whose original industry would appear to be that of dyeing. They now, however, follow various pursuits such as silk and cotton weaving, gold and silver thread making, carpentry, wood-turning, brick-laying and cultivation; and dyeing, except in Sind, Gujarát, Bombay City and a few other places, occupies a more or less subordinate position. According to the last census they number 51,740, distributed as follows:—

Gujarát	...	...	...	42,029
Deccan	...	...	...	4,472
Konkan	...	...	...	83
Karnátak	...	...	...	592
Bombay and Aden	...	...	...	4,564

They are to be found chiefly in the Native States of Cutch and Káthiáwár, and the Ahmedabad, Broach, Surat, Khándesh, Násik, Poona and Bijápur Collectorates. They are both Hindus and Mussalmans, but the former largely predominate. The Mussalman *Khatris* are Sunnis by faith, but form a distinct community, marrying among themselves and having a separate *jamat* or caste assembly. They are said to have adopted Islam because of some dispute with their priests, the Saraswat Brahmins, but they have a tradition that the Hindu *Khatris* are descended from a common ancestor with themselves; and to this day if a Hindu *Khatri* becomes a convert, he joins their community. They are also said to have originally come from Sind to Cutch some 250 years ago at the invitation of the then Ráo of that country and to have spread thence south to Káthiáwár and Gujarát as far as Bombay, chiefly emigrating during the terrible famines between 1813 and 1861 that almost denuded Cutch and Káthiáwár of their working population. In Bombay the home speech of the Mussalman *Khatri* is still a mixture of Sindhi and Cutchi similar to that of the Cutchi Memons; but their main means of intercourse is Urdu, which they speak with fluency. The Hindu *Khatris* generally speak Gujaráti. It is probable that they brought their knowledge of dyeing with them from Sind, but like the *Bhavsars*,

* These appear at one time to have been identical with the *Bhavsars*. A tradition still exists with the latter that when Paishuram was exterminating the Kshatri race, they were Rajputs living at Brij Mathura. Fearing their fate they became followers of one Ram Devji, a mendicant, and came to Márwár. This Ram Devji being a calender, *Chhipa*, his followers were at first called *Chipas*. Their present name they derived from their having placed faith, *bhava*, in this mendicant. (Bombay Gazetteer, Vol. V, p. 73.)

Another class who in some places do dyeing-work are the *Atars* or perfumers, who according to their own account are the descendants of Hindus converted to Mahomedanism during the time of Aurangzebe. Their principal business is to prepare and sell scented oils, perfumes, tooth-powder, &c., but lately having suffered from the competition of English lavender and other scents, they have mostly taken to new pursuits. Part of their business was to make and sell *kanku*, the red powder made from turmeric and used for Hindu women's brow-marks, and this may have led them to prepare red dyes from safflower and turmeric, and thence to dye turbans and *rumals* with these and European dyes, as they are reported to do in the Sátára District. They are, however, a very small community, numbering in all only 303 at the last census and confined almost entirely to the Deccan.

The truth is that the introduction of cheap aniline and alizarine dyes into India has had the effect of throwing open the industry to almost all who choose to take it up, as dyeing does not now require the special study and knowledge such as was necessary when the native ingredients were combined. Thus in Násik *Bohoras* are reported to have started dyeing with aniline dyes; and in Shikárpur, and probably in many other places, *Khatkas* or washermen now dye cheap clothes red in a large kettle of boiling water in which the colouring matter has been dissolved. The question of the supersession of native dyes by aniline and alizarine ones imported from Europe is treated more fully further on.

Besides the castes who have been mentioned in Ahmedabad and Surat, there are a large number of *Kunbi* dyers, who are Hindus said to have originally belonged to North-Gujarát and Ohampaner in the Panch Maháls and to have come and settled in Surat and Ahmedabad some 150 years ago. They worship the usual Hindu gods and goddesses, but the Bechraji goddess located near the Abu hills is held in special reverence. They are industrious and hardworking and reported to be a contented community, whose material condition is satisfactory.

In the same way that there is a special class of indigo-dyers, so there exists a large number of dyers who confine themselves mainly to the dyeing of turbans, handkerchiefs, &c., with shades of red and yellow obtained mainly from *kasumba* flowers, or the dried florets of the *Carthamus tinctorius* (safflower). In the Presidency proper these are generally Mussalmans or ordinary *Rangaris*, but in Sind there is a special class called *Khuhmbatis*, corresponding to the Kasumbawalas of Upper India, who purchase *khuhmba* (flower of safflower) in the bazar and with it produce the *khuhmbo* or bright red gowns worn by women. In Karáchi they are all Mahomedans and also print patterns on clothes in silver and gold and other colours.

In spite of the claim of the more important dyeing castes to be of Kshatriya origin, they are according to the Hindu system merely a division of the Shudra or servile class, and the status of the caste is comparatively low. Amongst artizans the dyer occupies a mediocre position next to that of the painter. As a class dyers are generally reported to be honest, hardworking, orderly, thrifty, and in spite of their occupation clean and neat. They are generally sober and simple in their habits; and though some are reported to drink and gamble, they do not do so to any very great extent. As a rule the women and children help the men in the less laborious part of the work. They generally send their boys to school, but are content to let them learn to read and write their native tongue only, and in most cases withdraw them at about the age of ten, when they are required to join their parents in their work. A boy will ordinarily become a skilled worker at eighteen or twenty. Their material condition cannot, on the whole, be described as prosperous. They earn their livelihood, but very few seem at all wealthy.

done by a caste called *Galiaras*, numbering according to the last census 748, of whom about half were Mussalmans and half Hindus.

Galiaras. In the Deccan, there is a Hindu caste called *Nilaris* or *Niralis* whose original occupation was to dye with indigo, as their name betokens. They are supposed to be a class of Marátha

Nilaris or Niralis. *Kunbis* who have taken to dyeing; but now through stress of competition they have mainly forsaken dyeing and taken to hand loom weaving or other occupations, while their place has been chiefly taken by Mussalmans from Upper India as in Násik, or from the Deccan and Cutch as at Poona. According to the last census, they numbered 1,739. In the Karnátak

Nilgars. there is a similar caste called *Nilgars*, who are Lingayats. They are generally numerous in large weaving towns and dye cotton thread with indigo, but suffer from the competition of other dyers. In Sind there is naturally a large amount of indigo-dyeing, as indigo is there produced in considerable quantities and dark blue indigo cloth forms the everyday clothing of the Sind cultivator. This indigo-dyeing is

Nirolis or Nirotis. generally carried on by a caste styled *Nirolis* in Upper and *Nirotis* in Lower Sind, corresponding to the *Niralis* and *Nilgars* of the Presidency proper. These are nearly all Mussalmans; but though Hindus will not work in indigo in Hyderabad, the same does not appear to be the case in Karáchi, where there are some 10 or 12 shops of Hindu indigo-dyers. *Nirolis* or *Nirotis* do not, however, confine themselves to indigo, but also dye in other colours. In Shikárpur, for instance, they are reported to dye cloth in twenty-two different colours. The total number of indigo workers and dealers in the Presidency is reported in the census returns to be 3,436, but the fact that 2,673 out of this number come from Sind shows that these statistics refer rather to indigo dealers than to indigo dyers and afford no proper clue to the number of the latter.

Considering the intimate connection between weaving and yarn dyeing, it is not perhaps surprising to find that most of the other castes who are reported to engage in dyeing are really weavers, some of whom have taken to dyeing in addition to their main industry; and so much is this the case that weavers, calenderers and dyers have all been classed together in the tables relating to occupation in the census returns. The principal of these are the *Salis*, *Momins*, *Hatkars* or *Devangs* and *Jadars*. The

Salis. *Salis* are one of the chief weaving castes, prevailing in the Deccan and Karnátak and numbering altogether according to the census returns 59,161. *Momins* are either Hindus from Upper

Momins. India, as at Málegaon in Násik, where they are reported to have settled in considerable numbers during the last twenty years, or are descendants of converted Hindus of the *Sali* and *Koshti*

Hatgars, Devangs and Jadars. castes, as at Poona. Those among them who practise dyeing do not intermarry with the others. *Hatgars*, *Devangs* and *Jadars* are weavers in cotton and silk who are almost entirely confined to Belgaum, Dhárwár and Bijápur. Those of these castes who are dyers are principally, as is natural, engaged in yarn-dyeing.

But besides weavers, it appears that tailors also have in some instances taken to dyeing. Thus in Belgaum there are *Shimpis* families engaged in calico-printing; in Bijápur *Shimpis* dye turbans, sheets and shawls and print chintzes; while

Shimpis. in Dhárwár *Namdev Shimpis* dye cloth and yarn. There is, however, a somewhat close connection in the Hindu caste system between *Rangaris* and *Shimpis*, as the following tradition shows. It is said that their ancestors were twin-brothers of the Kshatriya class, who on being pursued by Parshuram, hid in a temple belonging to the goddess Ambabai and sought the goddess' protection. The goddess gave one brother a piece of thread and a needle, and the other a paint which she spat at him, and told the one to sew and the other to dye. Meanwhile Parshuram begged the goddess to make over to him the two Kshatris, but she denied all knowledge of them and Parshuram had to go back disappointed. From that time the sewer became a *Shimpi* and the dyer a *Rangari*. This may help to explain the apparent encroachment made by the one on the domain of the other.

establishments receives only 6 to 8 annas a day, while for indigo-dyeing the wages are only 6 annas per diem. That this branch of the industry is generally but poorly remunerated may be judged from the fact that in Poona an indigo-dyer is reported to only get about 2 annas for dyeing the ordinary coat and pair of trousers of the Police uniform. For calico-printing, men are employed at a regular wage of Rs. 15 to 16 per mensem. In Shikárpur it is reported that dyers are, as a class, looked down upon by the rest of the population, and though there are some fair incomes, the industry cannot be said to be remunerative or flourishing. In Surat, while the material condition of the *Kunbi* dyers is fairly satisfactory, some living in houses of their own worth from Rs. 1,000 to Rs. 5,000, yet the Mahomedan dyers mostly live from hand to mouth, earning only 5 or 6 annas a day. Even in Ahmedabad, one of the chief centres of the dyeing industry, the profits obtained seem ludicrously small. Thus a piece of cloth costing 7 annas will, when dyed as a red *sari*, fetch (it is said) only 9 or 10 annas, leaving a margin of 2 or 3 annas to pay for the labour expended on it during 10 or 12 days and to provide a profit for the dyer.

As a natural consequence of the outside competition, almost all the dyeing now done by native dyers (except in some cases silk-dyeing) is for purely local consumption, and as a rule no trade worth the name is carried on with places outside the particular district in which the cloth or yarn has been dyed.* Thus formerly cloth used to be sent from long distances (e.g., Poona to Khándesh) to be dyed, but now the principal custom is everywhere entirely local. This restriction in the demand for native dyed goods and the small profits obtained have of course led to many dyers betaking themselves to other occupations, such as agriculture, brick-laying and labour. Even in cases where they still work as dyers, they often do not live exclusively by that trade, but also cultivate land and work as labourers. This is the rule in part of the Khándesh District, where a family consisting of a man, woman and two children is said to earn from dyeing only about Rs. 75 per annum. In the Násik District, on the other hand, it is said that dyers do not generally combine dyeing with any other trade, though in Yeola a few of them deal in cotton and gold thread.

The result of this withdrawal from the business of dyeing is very noticeable in some places. Thus in Surat, whereas there were 60 or 70 establishments of *Kunbi* dyers in the city about twenty years ago, there are now only 10 to 15; and whereas Mussalmans, *Shrawaks*, and *Banias* were formerly engaged in calico-printing in the city and surrounding villages, the business is now confined to four or five families in Surat City and the village of Warucha. At Sháháda, which is a centre of the dyeing industry in Khándesh, the principal dyers are *Karmi Bhavsar Rangaris*, whose numbers are variously estimated from 100 to 350, but of these only a very small number (variously estimated from 10 to 55) are actually engaged in dyeing, the rest having betaken themselves to other occupations. Again, at Hubli in the Dhárwár District it is reported that *Rangaris* used to dye rough cloth for *jajams* (light carpets) and *rusais* (bed quilts), but the falling off in the demand for such articles has put them out of this trade, and some of them have taken to dyeing on wood instead.

Leaving aside the few dyeing factories which have recently been established and the dyo-houses which are now attached to most of the mills in India, the appliances used by a native dyer in this country are of the simplest and roughest kind. His operations are usually conducted on some river bank or close to a well with a plentiful supply of water. The boiling is performed on a simple

* So far as there is any external trade in native dyed or printed cotton piecegoods, these are chiefly exported to Aden, Muskat and other parts in Arabia, Zanzibar, Persia, Turkey in Asia, Siam, Ceylon, Mozambique, the Strait Settlements, and occasionally Hongkong and the Treaty Ports in China. In 1894-95 about 40 lakhs of yards, worth about 12 lakhs of rupees, were so exported from Bombay. The trade is, however, quite overshadowed by that in coloured piece-goods of foreign merchandise re-exported from Bombay, which is over twice as large.

This is mainly due to the great competition which they have to meet with from Europe and elsewhere, and to the extension of the industry in India in consequence of the introduction of aniline and alizarine dyes, which has resulted in largely reducing their profits. Cotton-cloth dyers and printers suffer in consequence of the people having acquired a fancy for the cheaper and more brilliant imported fabrics*. Cotton yarn dyeing in the molussil has practically been extinguished in consequence of the large importation of coloured cotton yarn chiefly from England, Austria and Belgium,† and the local competition from the Indian mills and factories. Nearly all cotton spinning mills now have dye-houses fitted upon European principles, where they dye their own yarns; and at Máhim near Bombay there are two big dyeing factories which restrict themselves to colouring cotton yarns, and turn out a large quantity yearly for local consumption and export. In Ahmedabad and elsewhere in Gujarát there are also some dyeing factories, one of which is said to turn out about 500 lbs. of Turkey-red yarn per day. The native yarn-dyers necessarily suffer from this severe and unequal competition between themselves and powerful factories. Thus in Khándesh formerly English and country yarns of low counts (seven to ten) were dyed red and black, but this is no longer the case; and in Belgaum, although thread both of local and Bombay manufacture is dyed, the industry is on the decline owing to outside competition and the large import of red yarn from Bombay by rail. Silk-dyeing does not suffer to such an extent, though large quantities of manufactured silk piecegoods are imported from Ceylon, China, France, Austria, Italy and elsewhere; and in Bombay there is a silk manufacturing mill which has recently introduced printing on silk as a branch of its business.

Turban-dyers have not now nearly the work that they had formerly. Most Marwaris, Mussalmans and Marathas now dye their own turbans with safflower, and the partial substitution of *rumals* and caps for head-dress on the part of Hindus also strikes a blow at their industry. It is further a common complaint that since the famine of 1876-77 the bulk of the people have taken to wearing white head-scarves instead of coloured turbans. Then a change of fashion may seriously affect dyers who devote themselves to a particular branch of the industry or to a particular style. Thus in Khándesh *Bhavsars* used to print cloths known locally as *dandliye* and *shilad*, the former being worn by *Kunbi* and the latter by *Bhil* women; but these have now gone out of fashion, and the women have taken to wearing *saris* made by *Mominis*.

Mainly for these reasons the industry is not a thriving one; but for all that it provides a livelihood to many, and in some cases dyers are in comparatively affluent circumstances. In Bombay some of the Mussalman *Rangaris* are very well off, and own indigo factories and villa residences, while most of them live in houses of the better class. This is, however, the exception. In Hyderabad (Sind) it is estimated that the profits of a manufacturer in large centres such as Hyderabad and Hala would not exceed Rs. 20 a month; and the daily wage of an employé is only about 6 annas. Again, in Karáchi an employé in one of the ordinary Hindu or Mussalman dyeing

* This may be judged from the following figures showing the imports into Bombay of coloured printed or dyed cotton piecegoods during the last five years for which figures are available:—

Year.	...	...	...	Yards.	Value in Rs.
1890-91	...	...	...	160,109,727	2,41,18,353
1891-92	...	...	...	146,548,587	2,37,86,684
1892-93	...	...	...	159,143,034	2,46,68,941
1893-94	...	...	...	189,543,721	3,13,85,837
1894-95	...	...	...	173,207,470	2,79,91,376
Average	...	...	...	166,110,508	2,63,90,238

† 7,12,629 lbs. of such yarn of various counts, worth Rs. 5,18,092, were so imported into the Bombay Presidency during the year 1894-95.

II.—Table of Imports of Aniline and Alizarine Dyes into the Bombay Presidency.

Countries whence imported.	1891-95.		1895-96.	
	Quantity.	Value.	Quantity.	Value.
<i>Aniline Dyes.</i>	Lbs.	Rs.	Lbs.	Rs.
United Kingdom	16,156	42,443	12,532	27,117
Austria	271,602	4,73,338	327,305	5,21,876
Belgium	774,284	12,32,623	1,085,414	15,04,920
France	7,542	14,305	202	179
Germany	275,070	3,44,897	363,278	3,94,444
Holland	17,933	20,560	133,338	1,49,148
Italy	174,214	2,91,485	325,043	5,09,870
Others (Arabia, Aden, Ceylon and Hongkong)	101	88	50	117
Total ...	1,536,902	24,69,739	2,247,162	31,07,671
<i>Alizarine Dyes.</i>				
United Kingdom	160,126	1,00,322	271,862	1,50,782
Austria	263,172	1,48,831	280,080	1,68,865
Belgium	2,683,870	17,18,088	3,001,752	20,13,893
France	1	1	.....	...
Germany	45,842	26,360	1,194	742
Holland	454,086	3,35,460	1,008,335	6,30,353
Aden ... ..	.....	.....	6,760	3,464
Total ...	3,607,007	23,29,062	4,569,983	29,68,099

The goods entered as imported from Belgium are chiefly of German origin, being shipped *via* Antwerp, and it is probable that a large portion of the quantity shown as imported from Holland has also been manufactured in Germany or in other countries on the continent and shipped at Rotterdam for the convenience of the shippers. Germany, in fact, possesses the bulk of this business, but the trade with Austria and Italy is also thriving and both are gradually increasing their transactions in these dyes. On the other hand, that with the United Kingdom is falling away. It is said that the aniline dyes from the latter country are of a more costly description than those received from the continent, and are therefore not so readily taken up by consumers, who have a partiality for the cheaper article. The country of export also varies to some extent according to the colour of the dye required. Thus in Karachi, violet colour is said to be imported from France, blue from Switzerland, magenta from Huddersfield, orange and green from an aniline dye factory on the Rhine, and other colours from different places in Germany.

Of course all these dyes are not consumed in the Bombay Presidency, but are distributed from Bombay all over India, while a considerable quantity is re-exported to Hongkong, Persia, Turkey in Asia, the Straits Settlements, &c. That Bombay is the main port of importation for these dyes will be seen at a glance from the following figures:—

Class of Dyes.	Year.	Total imports into India (value in lakhs of Rupees).	Total imports into Bombay (value in lakhs of Rupees)
Anilino ... {	1891-95	28	24
	1895-96	37½	31
Alizarine ... {	1891-95	27	23½
	1895-96	32½	29½

fire-place constructed of brick and mud, and his apparatus chiefly consists of a large cistern or tub for the principal dye-beck, a hollowed stone answering for a mortar, with long wooden iron-tipped pestles for pounding dye-stuffs, a few cloth filters and some sundry articles such as brass and earthen pots, a copper vessel for boiling, &c. In indigo-dyeing, wooden barrels for vats and stone troughs are generally employed. In calico-printing operations the addition of a few tables or desks and printing blocks and trays is all that is required. As a rule a dyer's workshop is extremely dirty and untidy, and economy, simplicity and rudeness mark all his doings and belongings. His work is all hand labour; and his processes are tedious, complicated and imperfect, being still carried on more or less as they were by his ancestors before him, with the exception that aniline and alizarine dyes have taken the place of the madder or other vegetable dyes formerly used. In spite, however, of all this the native dyer obtains very creditable results, and has a marvellous aptitude for turning to account the various natural substances which lie at hand in his operations.

The immense revolution in Indian dyeing which has been effected by the introduction of aniline and alizarine dyes imported from Europe may here be conveniently noticed. These are now obtainable in almost every bazar of importance in $\frac{1}{4}$ lb., $\frac{1}{2}$ lb., and 1 lb. packets, or barrels of larger quantities. The following facts and figures taken from the Annual Statements of the Trade and Navigation of the Presidency of Bombay for various years will sufficiently show the enormous trade which is done in these articles with the Indian markets and the vast expansion in such trade which has taken place of recent years. The table given below explains itself:—

I.—Table showing the Imports into the Bombay Presidency of Aniline and Alizarine Dyes.

	Libs.	Rs.
Average of the five years ending 1886-87...	472,312	7,01,853
Do. do. 1891-92...	3,019,258	26,34,955
1892-93	5,373,245	43,76,326
1893-94	5,365,362	44,29,064
1894-95	5,148,999	47,98,801
1895-96	6,817,145	60,75,770

It will be noticed that even since 1891-92 the imports have more than doubled, while they are now nearly fifteen times as large as they were during the quinquennial period ending 1886-87. It is also noticeable that during the three years 1892-1895, though the quantity imported decreased each year, the value of the imports steadily increased; and this is mainly to be explained by the gratifying tendency on the part of consumers to use the better qualities. The fact that the price of the faster dyes has become somewhat lower is also said to have probably had something to do with the improvement in this trade. Until the year 1894-95 separate figures for aniline and alizarine dyes were not available as they were classed together in the Trade Returns, but it was known that the imports of alizarine dyes were increasing more rapidly than those of aniline. The following are the figures for the years 1894-95 and 1895-96 showing the different countries from which the dyes, aniline and alizarine respectively, were imported:—

Before a cloth is ready to be dyed with a fast colour, it has to generally undergo a preliminary process of preparation more or less elaborate,* the different stages of which may be recited as washing and bleaching, dunging, galling, aluming or mordanting, and again washing. By the process of *washing*, the cloth is freed from the foreign matters which adhere to its surface, whether naturally belonging to the fibre or purposely introduced during the operations of spinning and weaving, *e.g.*, starch and paste, grease and dirt. To properly remove grease and other impurities of a resinous nature, it is, however, necessary to resort to *bleaching* and boiling in an alkaline lye. The former process, which is successfully carried on in Europe with chloride of lime or bleaching powder, is slowly and imperfectly effected in India by the aid of the sun, air and moisture. The latter process is found more effectual when carried out in distinct stages as is done in Europe, but in the Indian process it is combined with another operation known as *dunging*.

Washing.

Bleaching.

Dunging.

Dr. Náráyan Dáji, in his pamphlet on the "Art of Dyeing in Western India" (1873), which furnishes much valuable information on the subject, thinks that this combination may probably be beneficial in one way, by the less chance there is of weakening the cotton fibre than would be the case with the uncombined use of alkalis, and by at the same time producing an emollient or detergent effect in the fibre. The dunging process also appears to have an intimate connection with the subsequent operation of mordants, alum especially. The dung contains phosphate of lime and aluminous and soluble matters, which by chemical action combine with the aluminous salt to form insoluble compounds within the cotton fibre and thereby produce fast dyes. In European dyeing, dunging, or as it is technically called *bousage*, once formed an important part, but now cowdung has been almost entirely displaced by substitutes such as the phosphates of soda and lime, the arsenites and arseniates of soda, and the silicates of soda. Even in India dung is in some places being replaced by soda for washing and bleaching purposes.

The operation of *galling* is an important step in the Indian process of dyeing. By it vegetable infusions, chiefly containing tannin, are applied to the cloth, so as to impregnate it with tannic acid, which reduces the alum subsequently applied to an insoluble state in the fibre of the cloth. This facilitates the application of a dye stuff to a tissue. The tannin substances are readily absorbed by most textile fabrics, notably cotton, linen and silk, but have so slight an affinity for wool that they are seldom applied except on account of their property of precipitating certain impurities from the dye-bath and thus preventing these being taken up by the fibre. The tannins almost universally used in the Presidency proper are myrobalans, and in Sind pomegranate rind and tamarisk galls. For silk dyeing, however, pistachio galls, chiefly imported from Persia or Kabul, are generally substituted as they produce better tints.

Galling.

Aluming.

The next stage of *aluming* is the most important one, as without it the colouring matter of all dyes, other than the so-called *direct* or *substantive* ones, would not be fixed permanently to the cloth. Most animal and vegetable colouring substances are naturally soluble in water and have not in themselves a strong affinity for tissues and so it is necessary to effect their conversion on the cloth into compounds which are insoluble in water. This is accomplished by means of the *mordant*. This is properly speaking a substance which has an attraction of surface for the tissue, a chemical affinity for the colouring matter in solution, and the property of forming an insoluble compound with the colouring matter. By virtue of the combination of these properties it is enabled to produce what are technically known as *colour-lakes* in the substance of the fibre, which thus becomes dyed. Generally the subsalt of a metallic oxide is used for this purpose: in India, principally alum. The term 'mordant' is however also applied to certain substances which have the property of altering the shade of colour, or of brightening the colour (such as lime, carbonate of soda, &c.).

* This, however, applies fully only to dyeing red, *i.e.*, what is generally called madder-dyeing.

These dyes being now so accessible throughout the Presidency, it is no wonder that the old indigenous dyes have been almost entirely supplanted, and in some cases have even ceased to be known owing to long disuse. More especially is this the case with those colours into the composition of which madder or manjit (*Rubia manjista*) used largely to enter. Madder may in fact be said to have been virtually driven from the market by its competitor, the artificial alizarine, and is now not even procurable in most bazars. The morinda root, known as *al* or *suranji* (*Morinda citrifolia*) was until some ten years ago generally used throughout this Presidency as a substitute for madder, with which it is closely allied. The process of preparing this root was however very tedious and costly. Thus in Surat the cost of grinding it into powder is reported to have been eight annas per maund (Surti), and it would take four men and four women one day to prepare 6 maunds of the powder. It was also necessary to add castor oil to the powder, while pounding operations were going on, to prevent its being blown away. It is further reported that those employed in the work used to be generally affected with asthma.

In this case, therefore, it would appear that there has been some advantage attending the substitution of the imported dye for the old one, and the saving of time, labour and cost in using the aniline and alizarine dyes is very great. Their principal defect is that the resulting colours are often harsh and glaring and soon fade into hideousness. It has, however, been suggested by Mr. H. K. Tavaria of the Victoria Jubilee Technical Institute, Bombay, that the fading character of the colours obtained may partially be accountable to the neglect of the Indian dyer. For instance, the red aniline dyes are, he says, scarcely treated with the requisite amount of soap and salts required to give a depth of tone and uniformity of colour. The manufacturers would appear to have latterly given their attention to this defect, and there are now to be generally had in the bazar at any *Bania's* shop two sorts of dyes, the price of which varies from 4 annas to Rs. 2 per 1 lb. tin, according as a *pacca* or *kacha* (*i.e.* fast or fading) dye is required.

Another defect of the alizarine and aniline dyes which is generally complained of is that they have a slightly detrimental effect on the fibre of the cloth, so that it does not last so long as it did with the old *al* preparation and other indigenous dyes used.

II.—Cotton Cloth and Yarn Dyeing.

Dyeing and printing of cotton fabrics is the main business of the dyer on this side as in the rest of India. From the figures of the census of 1891 given in Appendix I it will be seen that cotton dyers exist in every district of the Presidency, but are principally found in Bombay City ; Sind ; Ahmedabad, Kaira and Surat in Gujarát ; Khándesh and Sholápur in the Deccan ; and Belgaum, Dhárwár* and Bijápur in the Karnatak. The castes that are mainly occupied with this branch of the industry have already been detailed. The cloths generally used in dyeing and printing are :—

- (i) English piecegoods ;
- (ii) piecegoods made in Bombay and other local mills ;
- (iii) gunny, dungri and other coarse home-made cloth.

These are converted into *saris*, *ludis* and other women's robes, *phadkis* (scarves), *pisodis* (sheets), *rumals* (handkerchiefs), *kholias* (bed-cloths), *vazais* (quilts), *jajams* (floor-cloths), *asmangiris* (ceiling-cloths), *pardas* (wall hangings), &c. &c. Similarly in Sind the kind of cloths dyed and printed are reported to be *chadars*, *chanis* (sheets and scarves worn by women), *bujkas* (small square sheets of cloth used for tying up clothes or things in), *ajhraks* (head-scarves), *bochans* (waist-scarves), *peshgirs* (petticoats), *dastar khana* (small dining cloths) and handkerchiefs.

* In Dhárwár, however, no cloth dyeing is reported to be now carried on, only yarn-dyeing.

coast, Persia and Sind, contains about 40 per cent. of impurities, chiefly carbonaceous matter, sulphurates, lime and iron. The latter is dug up from the bottom of small lakes or ponds in Sind, and the impurities which it contains consist chiefly of silica, chlorides and sulphurates. In Dhárwár Fuller's earth is sometimes substituted and in Sind potash is also used. In a few places dung is added to this mixture.

Rinsing and drying. (4) The cloth is taken out, rinsed by being trodden down or splashed on a stone or board, and then spread out to dry.

The process (3) and (4) is repeated for several days, varying in number in different localities, but generally ranging from 3 or 4 up to 6 or 7. As a rule the cloth is steeped in the solution for the whole night and dried next day, but in some places, *e.g.*, Surat, it is kept in the solution for some time, then taken out, rinsed and dried twice daily. In Bijápur the wet cloth, after having been steeped in the mixture, is kept folded up for one day, and in order to keep it moist, some of the mixture is sprinkled over it, while occasionally it is also dried in the sun. This process has to be repeated seventeen times.

(5) The cloth is washed in clean water, but not so thoroughly as to remove the whole of the oil, and finally dried in the sun.

Washing. (6) Next comes the *galling*. The cloth is well soaked in a solution of powdered *hirdas* or myrobalans (fruit of *Terminalia chebula*). In some districts such as Kaira and Ahmedabad, *behdas* (fruit of *Terminalia bellerica*) are now chiefly used instead of *hirdas*, being cheaper. In Sind the solution is ordinarily made of powdered tamarisk galls,* oil and water. The period during which the cloth is kept in the mixture varies in different places. In Karáchi it is kept, for instance, from 1 to 3 days, while in most other places the cloth is simply well soaked in the mixture for a short time. It thus assumes a yellowish tint.

(7) The cloth is next wrung out and dried. In some places, *e.g.* Bijápur, the cloth is occasionally moistened with some of the *hirda* solution while drying.

Drying. (8) The cloth is now *mordanted* by being dipped in a solution of alum and water, to which in some places gum or a paste of tamarind seeds is added to make it sticky. In parts of Sind, Fuller's earth is also used by some dyers.

Mordanting. (9) The cloth is now ready for dyeing and is generally boiled with a solution of the dye until all the colouring matter has been absorbed by the cloth.

Dyeing. (10) In some places, *e.g.*, Broach, Kaira, Násik, and Thar and Pákar, the cloth is then soaked in dung for one night.

Further dunging. (11) It is next washed and spread out to dry gradually in the sun, water being sprinkled at intervals over the cloth, so as to brighten the colours. This process generally continues for four successive days, two days being given to each side.

Drying. (12) If required, the cloth is finally starched by being dipped in a thin paste of rice or wheat flour, or in a solution of babul gum, and then dried. In Ahmedabad cloths intended for exportation to Siam are described as being 'polished' before being put on the market; and a similar process of polishing and calendering is an important feature of the preparation in the Bombay *Khatrí* factories of the indigo-dyed cloths exported to Zanzibar and Mozambique.

* These are more easily obtainable than myrobalans, the tamarisk tree being very common in Sind.

The cloth, after being *alumed*, generally undergoes washing, by which the excess of tannin and soluble salts left by the decomposition of alum are removed, and the cloth is then ready for dyeing. This is almost invariably effected by immersing it in a solution of the dye in cold or hot water, until all the colouring matter has been absorbed or the desired shade obtained. After this all that is really necessary is to wash the cloth in clean water and dry it; but before being sent to market it is generally "finished," *i.e.*, starched and calendered.

Further washing.

Actual dyeing.

Finishing.

These are the main principles on which the preparation of the cloth and subsequent stages of dyeing are carried out by native dyers in India, but the exact methods followed, being founded on the varying experience of their ancestors or on guess-work with little or no chemical knowledge, may be said to vary in details in every district and almost in every village in the Presidency. The chief variations are in the washing and dunging processes and the time taken over the different stages. As a rule, it may be said that it takes generally from a fortnight to three weeks to dye a piece of cloth with a fast colour, and even this is an improvement on the older methods, in which the different operations involved in dyeing a piece of cloth would occupy about three months. It is of course out of question for the native dyer to approach in any way the speed with which fabrics and yarn are now treated and dyed by the aid of elaborate machinery, and if he is ever to be able to dye goods within anything like a reasonable time, the adoption by him of some sort of modern drying machinery which will render him independent of the sun's rays for that purpose seems essential. Not only is it impossible to dry dyed goods within any reasonable time by simple exposure to the sun's rays, but also the varying conditions of the atmosphere cause a troublesome uncertainty as to the result.

Leaving this however aside, the following description of the ordinary process followed in dyeing a piece of cotton cloth may be taken as of fairly general application, being the result of a comparison of all the methods reported from the various districts.

General process followed.

(1) The cloth is soaked in a solution of water and fresh dung. In the Bombay Presidency proper, sheep's or goats' dung is generally used, in Sind camel or cow dung. In some places, *e.g.*, Khándesh District, the cloths are soaked in *khunds* or *pucca* built pits, which are the common property of the caste. In other places the cloth is soaked in the dyer's own utensils at his house. In Sind potash is often added to the dung solution. The cloth is generally kept in this solution for one night.

Dunging.

(2) Next morning the cloth is taken out and washed with clean water at the river, if there be one, or other convenient spot, being rinsed and splashed upon a stone, &c., so as to remove as much as possible of the sizing. It is then spread out to dry and in order to sun-bleach it water is sprinkled over the cloth at short intervals until about 4 P.M., when it is finally washed and dried.

Washing and bleaching.

In some places, *e.g.*, Karáchi, the stages (1) and (2) are repeated, and in Sind the cloth next undergoes a steaming process which does not appear to be practised elsewhere in the Presidency. This is effected in an ordinary *khumb* or washerman's steaming basin. In Karáchi the cloth is thus steamed for one night, and in Thar and Párkar for two days continuously. It is then taken out, washed and spread out to partially dry.

Steaming.

(3) The cloth is next soaked in a mixture of water, oil and alkali. The oil generally used is castor oil or gingelly (til) oil, for which in Sind mustard oil and oil of *jhambo* (*Eruca sativa*) are sometimes substituted. The alkali used is, as a rule, the impure carbonate of soda known as *safekhar* or *papakhar*. The former, which is obtained from burning salt wort and other plants and comes chiefly from the Arabian

Steeping in alkaline lye.

coast, Persia and Sind, contains about 40 per cent. of impurities, chiefly carbonaceous matter, sulphurates, lime and iron. The latter is dug up from the bottom of small lakes or ponds in Sind, and the impurities which it contains consist chiefly of silica, chlorides and sulphurates. In Dhárwār Fullor's earth is sometimes substituted and in Sind potash is also used. In a few places dung is added to this mixture.

Rinsing and drying.

(4) The cloth is taken out, rinsed by being trodden down or splashed on a stone or board, and then spread out to dry.

The process (3) and (4) is repeated for several days, varying in number in different localities, but generally ranging from 3 or 4 up to 6 or 7. As a rule the cloth is steeped in the solution for the whole night and dried next day, but in some places, *e.g.*, Surat, it is kept in the solution for some time, then taken out, rinsed and dried twice daily. In Bijápur the wet cloth, after having been steeped in the mixture, is kept folded up for one day, and in order to keep it moist, some of the mixture is sprinkled over it, while occasionally it is also dried in the sun. This process has to be repeated seventeen times.

Washing.

(5) The cloth is washed in clean water, but not so thoroughly as to remove the whole of the oil, and finally dried in the sun.

Galling.

(6) Next comes the *galling*. The cloth is well soaked in a solution of powdered *hirdas* or myrobalans (fruit of *Terminalia chebula*). In some districts such as Kaira and Ahmedabad, *behdas* (fruit of *Terminalia bellerica*) are now chiefly used instead of *hirdas*, being cheaper. In Sind the solution is ordinarily made of powdered tamarisk galls,* oil and water. The period during which the cloth is kept in the mixture varies in different places. In Karáchi it is kept, for instance, from 1 to 3 days, while in most other places the cloth is simply well soaked in the mixture for a short time. It thus assumes a yellowish tint.

Drying.

(7) The cloth is next wrung out and dried. In some places, *e.g.* Bijápur, the cloth is occasionally moistened with some of the *hirda* solution while drying.

Mordanting.

(8) The cloth is now *mordanted* by being dipped in a solution of alum and water, to which in some places gum or a paste of tamarind seeds is added to make it sticky. In parts of Sind, Fuller's earth is also used by some dyers.

Dyeing.

(9) The cloth is now ready for dyeing and is generally boiled with a solution of the dye until all the colouring matter has been absorbed by the cloth.

Further dunging.

(10) In some places, *e.g.*, Broach, Kaira, Násik, and Thar and Párkar, the cloth is then soaked in dung for one night.

Drying.

(11) It is next washed and spread out to dry gradually in the sun, water being sprinkled at intervals over the cloth, so as to brighten the colours. This process generally continues for four successive days, two days being given to each side.

Finishing.

(12) If required, the cloth is finally starched by being dipped in a thin paste of rice or wheat flour, or in a solution of babul gum, and then dried. In Ahmedabad cloths intended for exportation to Siam are described as being 'polished' before being put on the market; and a similar process of polishing and calendoring is an important feature of the preparation in the Bombay *Khatri* factories of the indigo-dyed cloths exported to Zanzibar and Mozambique.

* These are more easily obtainable than myrobalans, the tamarisk tree being very common in Sind.

The importance to the dyer of a good and accessible water-supply can easily be judged from the above account. The water must also be suitable to the particular branch of dyeing in which it is used. Perfectly pure water, even if it could be obtained upon a large scale without much cost and trouble, would not in all instances answer the practical purpose of the dyer and printer. Experience teaches, for instance, that in madder dyeing, the presence of carbonate of lime in water is advantageous; on the other hand, sulphate of lime in any quantity is injurious to such dyeing. Similarly water from any source cannot be used for alizarine dyeing, as it can for the aniline colours. A proper amount of hardness is required, and the amount for each colour or lake obtained with alizarine dyes is not the same. Thus the dyer depends to a great extent for the success of his operations on the quantity and quality of water procurable for his operations. A striking instance of this is furnished from the western division of the Khándesh District. At Sháháda, where a large amount of dyeing is carried on, it is claimed that the water is particularly suitable for the purpose. On the other hand, at Nandurbár, which was formerly the centre of a dyeing industry, practically no dyeing has been done for 25 or 30 years, the reason assigned for the decay of the industry being difficulties about water. As a rule, running water is preferred when procurable, and the presence of large rivers in Sind and Gujarát helps to explain the predominance which the industry has there attained as compared with other parts of the Presidency.

For reasons already stated, comparatively little cotton yarn dyeing is now carried on by native dyers, and what there is is chiefly confined to the main dyeing centres. It is reported to be followed by *Kundis*, Mussalmans, *Galiaras* and *Khatris* in Ahmedabad, by Bhavsars and Chipas in Kaira, by ordinary Rangaris and Mussalman indigo-dyers in the Deccan, and by *Bandhgars*, *Nilgars*, *Nagliks* and *Namdev Shimpis* in Bijápur, Belgaum and Dhárwár. In Sind comparatively little yarn-dyeing, if any, seems to be carried on except in the jails. The chief colours with which cotton yarn is dyed are red, blue and black, but it is also dyed in yellow, green and other colours in small quantities. The dyed yarn is mostly used in making up *saris*, *lugdis* and other female robes as well as turbans, and in the Karnatak a coarse canvas cloth called *gudar* is woven with dyed threads in stripes at intervals.

A process of preparation, somewhat similar to that obtaining in cotton cloth dyeing, must be gone through when cotton yarn is to be dyed a fast red or any colour into the composition of which red enters. For other colours such as black, blue, yellow and green, the twist is merely washed in cold water to remove the size or starch. The process as it obtains in Ahmedabad and elsewhere is as follows for a bundle of 10 lbs. of white cotton twist.

2 or 2½ lbs. of sheep's or camels' dung is mixed with river water, say 4 or 5 lbs., sufficient to cover the twist. The dung is allowed to remain in water for 12 hours (from morning till evening) and then well mixed up with the water. The twist is then steeped in it in an earthen vessel (*kunda*). It is afterwards pressed with feet in the vessel for about 10 or 15 minutes. It is then taken out and squeezed. At night it is kept inside the house. The next morning it is washed in the river and then squeezed and brought home.

2 lbs. of *kharo* (carbonate of soda) are dissolved in 5 or 7 lbs. of water. The mixture is allowed to stand for about a quarter of an hour, when the sediment settles down and clear liquid comes to the top. 2 lbs. of castor oil are taken in another earthen vessel, and about 1 lb. or 1½ lbs. of the *kharo* solution are poured into it and well stirred with it from time to time for about half an hour till the whole of the *kharo* solution has been mixed with the oil. A skein at a time is then taken from the bundle of twist and put into the mixture and trampled in turn one above the other until the whole bundle is finished, which will be in about a quarter of

an hour. The twist is then taken out and squeezed. It is then left to dry in

Bleaching. the sun on bamboos arranged for the purpose. On the first day it is allowed to remain in the sun for about an hour, when it is again steeped in the mixture of castor oil and *kharo* solution, trampled down and squeezed, some water being added to the mixture, if required. The twist is then left to dry in the sun as before. This process is repeated three times with the result that by the fourth time all the mixture in the vessel will generally have been absorbed. The twist remains in the house for the night. The next day it is put to dry in the sun on bamboos from 6 or 7 A.M. till 5 P.M. It is then steeped in pure water, trampled and squeezed, after which it is kept the whole night in the house. This process is repeated for four days, i. e., in all* five days are taken up in the process of bleaching. The sixth

Mordanting.

day it is again washed in the river. It is then passed through an alum bath, squeezed, washed and dried, when it is ready for dyeing with alizarine. This is done, as in cloth-dyeing, by boiling the yarn (on a common *chal* or cooking-place) for from 1 to 3 hours in a solution of the dye, until all the colouring matter has been absorbed. Finally it is washed in clean water, squeezed and dried.

Dyeing.

In the old madder-dyeing the concluding part of the process after the yarn had been bleached was much more tedious. The skeins were one by one steeped in the madder and alum solution, and one by one taken up, stretched and again steeped. This process, which is called '*chal*,' was repeated three times, and done again at bed time and in the early morning. For the next two days the *chal* was repeated twice, viz., once in the morning and once in the evening, until the twist assumed a red colour. On the fifth day it was washed in the river and exposed to the sun on bamboos till quite dry. Finally it was steeped in a solution of carbonate of soda (*kharo*) and water, squeezed and then left on the bamboos to dry for such time as might be necessary for the purpose.

A.—SIMPLE COLOURS.

1. *Red*.—It may be unhesitatingly asserted that, for dyeing cotton cloth or yarn in red and shades of red, alizarine dye is now universally used throughout this Presidency. This is usually sold in the form of a yellowish powder or paste, which turns red when mixed with alum. In the old native preparation,

Dhavri flowers.

flowers of the *dhavri* or *dhayati* (*Woodfordia floribunda*) tree were added to the powdered *soranji* or *al* root, both being boiled together in water; and these powdered flowers are still nearly everywhere, except in Sind where their place is taken by tamarisk galls, added to the alizarine dye in the same way. The main reason for their use appears to be that the flowers contain as much as 20 per cent. of tannic acid which they yield to the dye-bath, and thus serve the same purpose as does the galling operation before explained. The flowers also contain a yellowish-brown colouring matter, which with alumina yields pink shades. This action may serve to modify and perhaps brighten the shade of alizarine or madder. The flowers further keep the bath acid, so that its colour remains a bright red even at boiling heat, whereas if the bath becomes alkaline it assumes a violet shade. They are mixed in proportions varying from $1\frac{1}{2}$ to $\frac{1}{2}$ of *dhavri* flowers to 1 of alizarine. For cotton yarn the proportion of *dhavri* flowers is reduced to $\frac{1}{4}$.

Alum is universally used as the mordant. The cloth or yarn will ordinarily be kept in the boiling solution of the dye until all the colouring matter has been absorbed and the water has become quite colourless. This generally takes from 1 to 3 hours.

An indigenous dye, which is still occasionally used for dyeing cloth red, is

Patang wood.

patang wood or bark, i. e., Sappan or Brazil wood (*Cæsalpina sappan*). This wood, which is chiefly imported from Siam and Malabar and is obtainable in the bazar at the rate of about Rs. 2 per maund of 12 seers, is chiefly used now for preparing *gulal*, the red powder which is thrown about at the time of the Holi festival. In Ahmed.

* In Kaira 8 days are so employed.

nagar, *patang* wood, after being reduced into powder, is boiled in water until two-thirds of the water has evaporated. The remaining liquid is then mixed with cochineal, producing a dye which is almost fast. In the main dyeing centres such as Ahmedabad it has however been entirely superseded by an aniline dye known as Patangia.

At Hebsur in the Dhárwār District it is reported that the local weavers prepare a sort of dyed canvas cloth called *gudar*, which is dyed red with an inferior kind of dye prepared by themselves from the powder of a reddish stone called *kyani-hallu*,⁴ well mixed with lamp oil.

Kyani-hallu stone.

Cochineal.

Cochineal is not now used for dyeing cotton, except occasionally in *kasumba* dyeing to produce a crimson shade.

It may here be noted that a confusion appears to have arisen as to the exact identity of the substance or substances variously known as *al* (Hindustani), *sorangi* (Gujarati) and *suranji* (Marathi), used in madder-dyeing. This seems to be due to two causes :—

Confusion as to the identity of *al* and *suranji*.

- (1) That the words *al* and *sorangi* are sometimes used synonymously and sometimes otherwise ; and
- (2) the word *sorangi* (Gujarati) or *suranji* (Marathi) has been confused with the word *surinji* (Marathi) used to denote the tree known botanically as the *Calysacchion longifolium* or *Ochrocarpus longifolius*.

Thus the root of the *Morinda citrifolia* or its closely allied varieties, which was before the introduction of alizarine dyes used so largely in this Presidency as a substitute for *manjit* or Indian madder (root of *Rubia cordifolia*), has been wrongly identified with the *Calysacchion longifolium* by Dr. Liotard in his Memorandum on Dyes of Indian Growth and Production (1881), page 32, and (probably in consequence) also in the Botanical Volume XXV and some others of the Bombay Gazetteer. The latter tree has, however, no connection with the alizarine yielding roots known as *al* or *suranji*: its flower buds called red *nagkeshar* only are used for dyeing silk and in perfumery and medicine, and the mistake has evidently arisen from the similarity of names.

In the alphabetical list of crops in the Bombay Presidency given in Hope's Manual, Form No. 17 II, the *Morinda citrifolia* or *al* has for its equivalent in Gujarati *sorangi* and in Marathi *al suranji*. In Gujarat at least, however, *al* and *sorangi* do not appear to be synonymous. Thus in Ahmedabad for dyeing 10 lbs. of cotton yarn red, formerly 4 lbs. of powdered *al* and 1 lb. of powdered *sorangi* were used with 1½ lbs alum. The substance called *al* is said to be no longer procurable, and is different from *sorangi*, the root of the *Morinda citrifolia*. Most probably it was another variety of the genus *morinda*, imported from Northern India or elsewhere and designated by the name under which it was there known, to distinguish it from the locally produced *sorangi*. Now, however, that neither *al* nor *sorangi* are used in dyeing and the latter is only cultivated in small quantities in the two districts of Khândesh and Sholápur, the matter, though it deserves notice, is not one of any practical importance.

2. *Yellow*.—For dyeing cotton cloth and yarn yellow, the substance almost universally used throughout this Presidency is the powder prepared from the rhizomes or tubers of the turmeric plant (*Curcuma longa*). The mother tubers contain more colouring matter and are much used under the name of *kocha haldi*. The colour produced is, however, as a rule fleeting, the reason being presumably that given by Dr. Liotard at page 83 of his Memorandum on Dyes of Indian Growth and Production (1881), viz., "the colour by itself is not of a permanent character, and mordants are employed which do not always render it fast." Thus alum, which is the general mordant used, will not by itself render the dye fast. The same is the case when turmeric is used in combination with the *kasumba* solution, to which lime juice or a solution of dried mangoes are added for extracting and brightening the colour. If, however, a solution of pounded pomegranate rind be added to

Turmeric.

⁴ This appears to be the same as red ochre (*ge, u*) and is said to be found in quarries near Hahh.

the alum solution, as is done in Sind, the resulting colour is fairly fast. The rind itself yields a yellow dye; but it is really used for its astringent properties, which serve to fix or clear the colours. Consequently it is chiefly employed in dyeing shades, such as yellow and orange, on which its own colour would have but little effect. The ordinary process followed is to dip the cloth successively in a decoction of pounded pomegranate rind and water, a solution of turmeric and water (to which in some cases potash is added), and finally a solution of alum and water, the cloth being wrung and dried each time. The turmeric and alum solutions may, however, be combined, as they generally are in the Presidency proper. Thus in Bijápur the white *khachi* or sheet to be dyed is simply wrung out in a mixture of two seers of turmeric, six seers of water and two tolas of alum, and then left to dry in the sun. Sometimes *chunam* or lime is added to the turmeric solution to brighten the colour, and in some places alum is not used at all, but merely lime juice water or a decoction of sliced and dried mangoes, as in *kasumba* dyeing. In Broach a fast yellow dye is reported to be obtained by combining turmeric with *sorangi*, or rather the alizarine substitute, in the following manner. The cloth is first soaked in a mixture of turmeric and *sorangi* and kept in the shade for about two hours, after which it is dried and soaked again in a solution of *kharo* (impure carbonate of soda), with the result that the cloth is taken out red. An immersion in the alum solution, however, turns it yellow. The resulting colour is most probably a shade of orange.

Aniline dyes are now largely used instead of turmeric. In Ahmedabad it is reported that about one-fourth the quantity of cloth coloured yellow is so dyed, though, strangely enough, they are not used for cotton yarn. Alum is the mordant employed. In the jails in which dyeing is carried on, *guljaleel* or *asbarg*, a yellow dye extracted from the dried flowers and stalks of a plant called *Delphinium zalil*, grown and imported from Beluchistan and Persia and chiefly used for dyeing silk, is also being substituted for turmeric in wool and cotton-yarn dyeing, on account of the fading qualities of the latter. *Kesuda* flowers, or the bright scarlet flowers of the *pallas* (*Butea frondosa*) tree, which is common in most parts of the Presidency except the Southern Konkan, especially in Gujarát, are often employed to produce a fleeting yellow dye. This is extracted by simply pressing the flowers when fresh, or boiling them when dry in a weak solution of lime-water. In the Dhárwár District, these flowers, there known as *muttal* flowers, are used by the *Patbegars* for dyeing cotton yarn in three separate colours, viz., *kesari* or *kapil*, yellow, and *limbawali* (light yellow), according as the proportion of *muttal* flowers be greater or less. The dye obtained is, however, elsewhere more commonly used by private individuals for dyeing their own clothes than by regular dyers.

3. *Blue*.—Indigo is used everywhere, and is one of the few dye-stuffs of Indian growth, which has not given way to any very appreciable extent to the various artificial substitutes which have been placed on the market. This appears to be mainly due to the fact that no substitute resisting the action of acids, &c., as the natural indigo does, has yet been produced; and even the attempt to combine natural indigo with other artificial preparations is said not to have been satisfactory, the resulting colour failing to properly stand the eau-de-cologne test usually resorted to by native dealers in indigo-dyed goods. The use of indigo substitutes is, however, much simpler, less tedious and more manageable than the present indigo vat dyeing, which needs expert workmen to properly prepare the dye and to decide what number of dips are required to produce the right depth of colour; and when a cheap substitute, free from the defects of the present ones, is put on the market, indigo-dyeing may be expected to undergo the same revolution as Turkey-red dyeing did on the introduction of alizarine.

The principle on which the native process of indigo-dyeing is conducted is explained by Dr. Narayan Daji to be as follows. When indigo-blue or indigo-tin (to which the drug owes its tinctorial properties) is brought in the presence of alkaline substances (in the native process carbonate of soda and lime) into contact with bodies which readily absorb oxygen, there is formed, with simultaneous decomposition of water, indigo-white or reduced indigo, which possesses

the double property of being soluble in the above alkaline liquids, and also, when exposed to the air, of turning blue and passing into the insoluble form of blue indigo. In the native process the reducing agency is generally afforded by the process of fermentation of sugar or dates, mhowra flowers, &c. The use of indigo as a dye material is in a great measure based upon this reduction. It is on this account that, when dyed cotton is just taken out of the blue vat, it appears green but rapidly assumes its deep blue tone from contact with the air. The resulting deep blue colour is permanent without the use of any mordant, but every colour is not fast in the production of which indigo enters. If the dye with which it is combined is fast, the product will be fast; but if like safflower the second dye is fleeting, the permanence of the compound colour will depend on the amount of indigo used and the order in which the two dyes are applied to the cloth. In no case are the various dyes mixed: therefore, if the indigo is applied first, the compound will as a rule be fast to some extent, while it may be altogether fleeting if the first dye applied be the fleeting one.

The process of preparing what is called the *khara pip*, or indigo vat for dyeing cotton goods, varies of course in different places, and is more or less elaborate according to the quality of the dye required. The process followed in the Khândesh District will exemplify the more elaborate preparation of the dye.

First day.

Mix lime dust and the ashes of dried plantain stalks in equal proportions and add sufficient water to make into the consistency of a paste. The mixture, which will be hereafter referred to simply as the mixture, should then be pressed and put on one side.

Second day.

An earthen pot, large enough to hold 16 pounds of water, is placed on a tripod: at the bottom it has a hole, which is corked up, so to speak, with a bit of cloth. In the bottom of the pot are laid some pieces of bamboo with a little grass.

Upon this are put 16 seers by measure of the mixture, and to start with 4 pounds of water are poured upon the top.

A black essence then oozes through the partially corked hole at the bottom and is caught in a vessel placed beneath for that purpose.

More water is then poured in, about 16 pounds in all, till the essence begins to take a reddish tinge.

Third day.

The essence collected on the second day should again be poured through the earthen pot, in which the previous day's mixture, however, should first be replaced by a fresh supply.

Indigo is then broken up and soaked for one day in the doubly concentrated essence so obtained.

Fourth day.

The soaked indigo is powdered and thrown into an earthen vessel or *ranjan*, big enough to hold 128 lbs. of water: 112 lbs. of water are poured upon it: while half a seer of the powdered seed of the *Tarota* tree (*Casia auriculata*), whose action is supposed to be that of starch in the indigo solution, is boiled in 4 seers of water and added.

Fifth and sixth days.

The above concoction is stirred twice, morning and evening, with a stick.

Seventh day.

Some more of the essence as prepared on the second day is poured into the concoction.

Eighth and ninth days.

The concoction is further stirred and the *Rangaris* test by sight and smell whether it is ready. If it looks reddish blue they consider it ready; if the

smell is not sufficiently strong, they add moist lime according to requirements up to a maximum of 10 tolas.

The dye is generally ready on the eighth day and always on the ninth day.

A very similar process is described as being followed in the Bijápur and Dhárwár Districts, with a few variations in detail; but *chunam* or wet lime is stated to be added daily at short intervals. This substance is used almost everywhere. It promotes fermentation and also clears the colour. Besides the plantain the ashes of plants such as the *kantemat* (*Amaranthus spinosus*), the prickly *harivi* (? *Euphorbia tirucalli*), and the *rajgira* (*Amaranthus paniculatus*) are also used for the carbonate of potash which they contain; but in many places *sajekhar* (impure carbonate of soda) is used instead.

It has already been mentioned that the necessary deoxidisation of indigo-blue into indigo-white is in India generally brought about by fermentation, which is (as stated in Buck's "Dyes and Tans of the North-West Provinces") ordinarily excited by the addition of certain alkaline substances together with some saccharine matter, such as sugar, *gur*, dates, &c. It is curious, however, that none of the reports from the Deccan and Karnatak mention the use of the latter, except in the case of the less elaborate indigo dye prepared by Mussalman *Bangaris* in Khándesh for dyeing turbans, where it is stated that 1 seer of jagri is used to $\frac{1}{2}$ seer of lime and 1 seer indigo. This can scarcely be a pure oversight, and I notice that Mr. McCann in his "Dyes and Tans of Bengal" (1883), pages 123-4, notices the same absence of any mention of the use of *gur* or molasses along with alkaline matters to promote fermentation in the majority of the reports received by him from the districts in Bengal. The account given of indigo-dyeing in Dr. Liotard's memorandum on Dyes of Indian Growth and Production (1881) shows, however, that the use of molasses, &c., in the indigo vat is general in most of the provinces of India, and it is difficult without the presence of some such saccharine matter to account for the fermentation which sets in. Possibly it may be an omission due to the Indian dyer using simply the refuse of dates and the matting of palm leaves in which dates are imported into this country instead of costlier substances (as he is stated to do in Mr. Tavaría's pamphlet on "The Dyeing Industry in India," 1895, page 11), and this escaping the notice of the reporting officers. But the point is one which seems to need further elucidation.

In Sind similarly no mention is made of the use of *jagari*, molasses &c., though Dr. Liotard mentions it in his memorandum already alluded to (page 112) as being employed in the indigo vat.

In Gujarát, however, mhowra flowers, dry dates and molasses are, as a rule, used together with lime and *sajekhar* in order to promote fermentation. The following account of the rules followed for preparing the dye in the Shikárpur Prison well illustrates the ordinary process and the care which must be taken in the preparation:—

Take—

Indigo (2nd sort) ...	...	...	...	3 lbs.
Jagri ...	...	...	...	2½ "
<i>Sajekhar</i> ...	...	...	...	2 "
Lime, Surti (in powder) ...	...	...	...	2 "

Get an empty cask (capable of holding 42 gallons water) and bury it in the ground. Take 2 lbs. of indigo and steep it in a little cold water for 6 hours to soften it. Take it out and throw it into a stone mortar and reduce it to a fine paste with a round stone. Put this paste into a copper pot containing 10 gallons of cold water. Mix up and leave it for half an hour to settle. Empty all the clear dye into the cask, throw the residue again into the mortar, grind and put it again in a chatty containing further 10 gallons of cold water, mix, and when settled throw the clear dye into the cask. As there will be hardly any dye left unextracted after this, the residue, which will be gravel, may be thrown out.

There will now be 20 gallons of dye in the cask ; add to it another 20 gallons of cold water and the cask will be nearly full.

After this take—

Jagri ...	...	...	...	...	1½ lbs.
Sajekhar	...	...	...	...	1½ „
Lime...	...	...	...	...	1½ „

mix together, and put it into the cask containing the indigo-dye. This must be left for 3 days to digest, but every day, both morning and evening, the dye should be well stirred with a bamboo stick.

On the 4th day add—

Indigo	...	...	...	...	1 lb.
Jagri	...	...	...	...	¾ „

The indigo should be dealt with in the way shown above, but with this exception, that instead of using additional cold water, indigo-dye from the cask should be made to answer the purpose. Keep stirring morning and evening daily.

On the 7th day add—

Lime	...	...	...	...	½ lb.
Sajekhar	...	...	...	...	½ „

In a day or two more the dye will be fit for use, and will now need nothing further (except stirring morning and evening daily) for some time, *i.e.*, until 20 or 30 lbs. of cotton are dyed in it. The dye will then have lost its strength and there should therefore be added—

Indigo	...	...	...	...	1 lb.
Jagri	...	...	...	...	¾ „
Lime	...	...	...	...	½ „
Sajekhar	...	...	...	...	½ „

The following are the signs by which the dye may be known to be in perfection :—

I.—The dye will assume a greenish colour.

II.—Cotton steeped in it will appear at first quite green, and on being exposed to the air will gradually become dark.

III.—The froth which rises after stirring with a bamboo will have a bright dark blue colour and will never subside.

Without each and every one of these signs, the dye must be considered as unfit for use. When such is the case, resort to the following remedies, which if observed will generally set the dye right :—

I.—Taste the dye : if it be saltish, add jagri ; if it be sweet, add lime and *sajekhar*.

II.—If this fail, take out half of the dye in a copper pot and boil, and throw it back into the cask containing the other portion of the dye and stir it well. This will in 2 or 3 days give tone to it.

III.—But should this also fail, take out three-fourths of the dye into pots. Take up the residue into another pot, add a small quantity of the dye, strain and throw away all the gravel you may find, and put the dye back again into the cask. Lime and *sajekhar* contain a great quantity of gravel.

IV.—When there are more than one cask of this dye, and one of them happens to be good and the others spoiled, the residue as well as the portion of the dye from the good cask, transferred to the spoiled ones, generally sets them right.

When lime and *sajekhar* are added, they should always be put in one corner of the cask. When the dye wants adhesiveness (*chikass*), add lime alone. If the dye be spoilt and nothing can rectify it, throw it out and prepare a fresh dye.

Of course the ordinary native dyer does not employ merely a barrel or cask, but has what are ordinarily called *kundis* or *ranjans* (in Sind *kun* or *kunar*) for the purpose of indigo-vats. These

Indigo vats.

are large circular open topped wooden barrels or earthen vessels sunk in pits in the ground, between 3 and 4 feet in depth and about 2 feet 3 inches in diameter, able to hold about 300 gallons of water. These pits are first well plastered with dung and clay. It must be noted that it is most important to keep the vat closed during the time that the mixture is digesting and only undergoes periodical stirring, for, as before mentioned, the indigo-white (which is in process of manufacture) on exposure to the air rapidly takes up oxygen from the atmosphere and becomes converted into the insoluble indigo-blue. Another point which requires notice is that it is not necessary to prepare the dye afresh in the way described on each occasion, but some sediment from an old vat is thrown into the new solution which has been prepared of indigo, lime and *sajekhar*, and the next day the dye is ready. This is the process when a new vat is started. In ordinary cases the liquid in the vat is simply renewed by adding lime, carbonate of soda and indigo, generally in half the quantities used at the commencement. The foam which rises is often gathered, made into balls and dried, being kept for rubbing on cloth in patches, where the dye has not properly taken.

The application of the dye is very simple. The cloth is first soaked in water for some time and then immersed in the indigo vat, well soaked for about half an hour, and then taken out, squeezed and exposed in the sun to dry. This process is repeated generally three times on three consecutive days, when the required depth of colour is obtained. For light blue only one dipping in the vat is required, but for darker shades fine and valuable cloth often undergoes as many as ten. The cloth is generally dipped in different vats successively.

In the City of Bombay indigo-dyeing is mainly carried on, as already mentioned, by Mussalman *Khatris*. There are some four large indigo-dyeing establishments in Matunga and Sewree engaging from 100 to 200 workmen, and about 12 small ones, giving employment to from 30 to 50 skilled workmen, besides a large number of unskilled (*Ghati*) labourers. The capital laid out in these establishments is said to average from Rs. 1,00,000 to Rs. 1,50,000 in the larger and from Rs. 20,000 to Rs. 50,000 in the smaller. The dyeing shed is generally a stone and lime building, about 80 or 100 feet long and 30 feet broad, with an elevation of from 40 to 50 feet. On each side along the length of the shed is a row of from 20 to 30 buried tubs or indigo vats about 2 to 3 feet across and 8 to 10 feet deep. In one side of the factory is kept a cistern about 10 feet square and 5 feet deep, supplied with water from the Vehar Lake. An adjoining shed is filled with large and small wooden tubs secured by iron bands for dyeing purposes. Besides these there are calendering and sizing sheds and a double line of cottages for housing the workmen employed in the factory, the Hindu or *Ghati* labourers being lodged away from the others. These latter are Marathas from Poona, Satara and other parts of the Deccan, who are paid Rs. 15 monthly, while the work they have to perform is said not to occupy them more than 8 hours a day with breaks. They are chiefly employed in the preliminary washing of the cloth, which is trodden under foot in water for about an hour, and then left in it some 4 or 5 hours, until the sizing has been removed. They also, however, assist in the other operations. The indigo is ground and kneaded by old women of the *Rangari* class, who are paid by piece-work from annas 4 to 1 rupee the maund, according to the hardness of the indigo they have to grind. When the indigo has been ground with water into a sufficient consistency, it is handed over to the *Rangaris*, who put it in the vats and prepare the dyeing solution, two maunds of indigo being required for twenty vats, i.e., 4 seers per vat. The pieces of cloth are brought out dripping from the cistern and dipped in the vats, each piece being given two dips of about 5 minutes' duration. They are then, after being well wrung, taken to the sizing shed, where each piece is well soaked in sizing made up of *babul* (*Acacia arabica*) gum, aniline purple dye and water. Next the cloths are taken to the drying ground, where they are opened out and spread on the ground by *Khatris* boys, who after they are dried fold them up neatly, each fold being a foot and a half long and a foot broad. These folds have to be specially well done, as the calenders, who are either Cutch *Dhobis* or *Bundelas* from the north, polish only the outside ones. The calendering is done with the aid of wet clay, which is applied to the folds

requiring the greatest polish, and *mungras* or large wooden mallets. After being calendered, the cloths are ready for delivery and are chiefly exported to Zanzibar and Mozambique. The cloth produced is of two kinds, called respectively after those two countries. The Zanzibar cloth is dyed a simple dark blue; the Mozambique a purplish dark blue. The former sells at Rs. 1-8-0 the piece, the latter at Rs. 2. The cause of the first being cheaper is that the cloth is dyed in indigo mixed with an aniline purple dye and requires only two immersions, whereas the second admits of no adulteration and requires seven dips.

The dyeing and sizing operations are done by *Khatris* only. These belong for the most part to Cutch, but a few are from Sind and Mekran. They generally come to Bombay as boys, and after learning the work in the factory begin to earn a salary of 8 rupees a month, which in from one to three years, according to the respective ability of each, rises to the full pay of Rs. 18 a month, with free board and lodging. The work is, however, hard, as the men are engaged from midnight till day-break in dyeing operations and from 9 to 11 or 12 in the morning in the sizing-shed. This is, however, no doubt considerably mitigated in practice; and in one dye-house at any rate the workmen are divided into three hatches, who are set to work eight hours each.

For *Firoze* or turquoise blue, generally a solution of indigo lightened in colour is used. Turbans are often dyed this colour with a mixture of blue vitriol (sulphate of copper) and lime in the proportion of 1 to 2, but the resulting dye is fleeting.

4. *Black*.—A shade which very nearly approaches that of black can be obtained by prolonged or repeated immersions of the fabric in the indigo vats, and in many of the reports this is the only process indicated for dyeing black. The use of sulphate of iron, commonly known as copperas or green vitriol and in the vernacular as *Lirakas* or *hirakashi*, which is imported from Europe and sold at the rate of about Rs. 1½ per maund, is however now almost universal over all this part of India. This is generally combined with *hirdas* (*Terminalia chebula*) or *behdas* (*Terminalia belerica*) for the purpose of clearing the colour.* Thus in the Broach District 1 lb. of cloth is plunged into water, in which ½ lb. of *hirakashi* and ¼ lb. of myrobalans have been dissolved and the cloth is then dried in the sun, the process being repeated 5 or 6 times. In Kaira the proportions used are stated to be 1 oz. of *hirakashi* to 7 oz. of *hirdas*. Other substances are however commonly added. Thus in Poona a black dye for turbans and *saris* is said to be prepared from the following ingredients:—

<i>Hirdas</i> ...	...	...	12 oz.
<i>Behdas</i> ...	...	...	½ lb.
<i>Arlas</i> (<i>Phyllanthus amblicus</i>)	...	...	½ "
Pomegranate rind	...	...	1 "
<i>Hirakas</i> ...	...	...	8 oz.
English blue powder	...	...	3 lbs.

This is sufficient to dye a *sari* 10 cubits in length.

In Bijapur the following process is followed. A piece of *khadi* (white coarse cotton cloth) is soaked for one day in a mixture of three gallons of water and half a seer of *hirdas*. The sheet is then dried in the sun and afterwards again soaked in a mixture of one-fourth of water with *hirakas*. The cloth is next again dried, and then steeped in water mixed with one tola of *sorangi* (madder) or cochineal and boiled. The sheet thus takes a fast black colour.

In Sind the cloth is often dyed first with indigo for the purpose of producing an antimony coloured black, and a decoction of tamarisk berries or pomegranate peel takes the place of the *hirda* solution. In the Hyderabad and Thar and Parkar Districts, another shade of black is obtained by finally steeping the cloth after being dyed as above in successive preparations of turmeric and alum. This in combination with the indigo would give a greenish tinge to the cloth, which probably accounts for the colour produced being locally known as emerald or dark green (*kuttu*).

* Ferrous tannate is thereby fixed on the fibre and is rapidly oxidised in the air to ferric tannate.

The Assistant Collector, Hyderabad, says, however, that it is simply a deep jet black, and ascribes the name to the extreme perversity, which, he says, characterizes Sindhis in their designation of several colours, notably in the case of green, which they commonly apply to camels.

For calico-printing, however, a sort of iron or black liquor, which is obtained by dissolving scrap-iron in water with some fermenting substance such as dates, molasses or mhowra flowers, very commonly takes the place of sulphate of iron; and the same is also in some places used for dyeing cotton cloths, as it does not have such a detrimental effect on the fibre as *hirakas*, which is said to eat it away. The *modus operandi* is very simple. Take some old iron rubbish (generally about 20 lbs.) and burn it. When it becomes cold, wash it in cold water. Then put the iron into an earthen vessel with about 200 lbs. of water. Take 2 lbs. of mhowra flowers (or if these be not available, 2 lbs. *jagri* or dates), put them in a woollen bag and tie up the mouth of the bag. Put this bag into the vessel containing the iron and water. Tightly cover over the mouth of the vessel and allow the contents to remain in it for about five days, the bag of mhowra flowers being taken out on the sixth day. The iron liquor is then ready. If, however, required for calico-printing, some tamarind seed paste or gum is generally added to make the mixture sticky. Thus in Ahmedabad, 5 lbs. of the iron liquor prepared as above are taken and 1 lb. of tamarind seed flour and $\frac{1}{2}$ lb. of green vitriol (*hirakas*) added. These are boiled together for about an hour and the mixture is then ready for use. To get rid, however, of the bad smell which results from the use of the iron liquor, the cloth is in Broach said to be washed again with boiling water mixed with a little *suranji* or alizarine dye. The black also thereby acquires an added brilliancy.

No vegetable dyes seem now to be used for dyeing or printing black and the use of aniline blacks seem also rare. None, for instance, are employed in Ahmedabad, where considerable use is made of other aniline dyes. This is somewhat curious, because at any rate till recently the black was reputed to be the most permanent of all the aniline colours imported into India (see Liotard's Memorandum on Dyes of Indian Growth and Production, page 142). In Shikárpur, however, it is said that a black dye is obtained by putting $\frac{1}{10}$ seer of *kacha* imported colour and $\frac{1}{10}$ seer gum in water, which is boiled and filtered. The sediment so obtained will blacken cloth to which it is applied.

B.—COMPOUND COLOURS.

These are—

- (1) *Purple, violet, lilac, lavender*, produced from *red* and *blue*;
- (2) *Green* and shade of *green* from *blue* and *yellow*;
- (3) *Orange* and shades of *orange* from *red* and *yellow*;
- (4) *Brown, grey, drab, maroon, razel, puce, brick-colour, dove-grey, &c.*, from *black* and *other colours*.

The fabric to be dyed is generally steeped first in one colour and then in another. Different shades are, however, produced not only by the use of different dye stuffs, but also by varying the proportions thereof; and the bearing which alkalies and mordants have upon these has also to be considered.

(1) *Purple*.

The ordinary method is to dye the cloth or yarn first with alizarine red and then with indigo according to the usual processes described above under *red* and *blue*. In Broach, however, the *Galiaras* use a decoction of the bark of the *kasila* tree instead of alizarine red for this purpose. The bark of this tree, which is said to grow in the jungles of Jámnnagar, is sold in the bazar at Re. 1 per maund, if new, and ten annas per maund, if old. This, when pounded and boiled with water, gives a red colour something like that of *kasumba*, and produces a deep purple shade, like that of the *jambul* fruit, on

indigo-dyed cloth. A sort of purple is also produced by combining black and red. Thus in Kaira the ingredients given, as also the proportionate quantity of each to make one pound of the colour, are as under :—

Green vitriol (<i>hirakashī</i>)	...	...	5 tolas.
Alum	...	...	10 "
Red alizarine dye	...	...	20 "
Turmeric	...	...	5 "

Similarly in the Upper Sind Frontier cloth is dyed purple by successive dippings in solutions of—

(1) Tamarisk galls	...	...	$\frac{1}{2}$ lb.
(2) Green vitriol (<i>hirakas</i>)	...	...	$\frac{1}{2}$ lb.
(3) Alum and			
(4) Red alizarine dye	...	...	$\frac{1}{2}$ lb.

In Broach a purplish black is also said to be produced by merely adding alum to the iron liquor obtained as described under *black*.

In Shikārpur the *Nirolis* are reported to produce a dye called *kishnishi*, or raisin-colour, with merely pomegranate rind, cotton-flowers and alum, but the resulting colour is probably fleeting.

Aniline dyes are now in very common use for this and other compound colours, nearly every shade that may be desired being now obtainable in the bazar.

(2) *Green, &c.*

This is generally produced by first dyeing the cloth or yarn with indigo and then with turmeric, or by the use of aniline dyes. Indigo and turmeric. The turmeric, as in ordinary yellow-dyeing, is usually combined with alum, *chunam* or pomegranate rind, for the purpose of fixing or brightening the colour. Less pomegranate rind is, however, required than for dyeing pure yellow. In Sind a green colour known as *sao* is produced in a similar way with the addition of cotton-flowers, which are used by the *Nirolis* or *Nirotis* in the composition of several dyes, into which red or yellow enters. The ordinary green dye is, however, simply produced by successive dippings in indigo, pomegranate peel decoction and a solution of turmeric and alum. *Papad-khar* (impure carbonate of soda) is sometimes added. All shades of green may be obtained by varying the shades of indigo blue; the darker the cloth is dyed with indigo, the darker will be the shade of green, and *vice versa*. A dark green or almost jet black shade, locally known as *kat-tu*, which is produced in Sind with the aid of sulphate of iron (*hirakas*) has already been noticed under *black*. A similar use is made of *hirakas* in the Bijāpur District, where in combination with *kakad-singi* (*Pistachia integerrima*) a fleeting green is thus produced. The process is described as follows. Three seers of *kakad-singi* powder are boiled in $1\frac{1}{2}$ seer of water and then kneaded. The ball thus prepared is dissolved into six seers (*pakka*) of water, two tolas of alum powder and $1\frac{1}{2}$ tolas of sulphate of iron. About seven or eight sheets of *khadi* can be dyed with the mixture so produced.

In Ahmedabad about one-fourth of the cloth dyed green is now coloured with aniline dyes; and these are extensively used everywhere for the purpose, alum being the mordant commonly employed. These are often combined with other native ingredients to vary the shade. Thus in Shikārpur, the colour called *zangasi*, or green verdigris, is produced simply with aniline green and alum; while for the shade known as *pustoki*, or pistachio-nut light green, the aniline dye is combined with pomegranate rind, copperas and cotton-flowers. Another shade called *kabutri* or dove-colour is similarly obtained by adding copperas.

(3) *Orange, &c.*

This does not appear to be a favourite colour except in safflower-dyeing, which is described later on; and when this shade is desired on cotton fabrics, aniline dyes are generally used for the purpose. In Sind a reddish-yellow or almond colour, known as *badami*, is produced by first dipping the cloth twice in water boiled with one pound of pomegranate rind and drying it in the sun

each time. It is then dipped in water mixed with about $\frac{1}{2}$ lb. of alum and dried; then washed in pure water and dried again. After this the cloth is dipped twice in water mixed with $\frac{1}{2}$ lb. of catechu and 2 tolas of powdered lime. It is finally washed in pure water and dried. The resulting shade is, however, more probably one of brown than orange.

(4) *Brown, Grey, &c.*

This is usually obtained from sulphate of iron, catechu, tamarisk galls, and occasionally from the bark of the babul tree (*Acacia arabica*). Thus in Sind the cloth is dyed a snuff colour, called *nasi*, as follows. First, 1 lb. of powdered pomegranate rind is boiled in water. The cloth is then twice dipped in it and dried each time. It is next washed in water mixed with alum and dried. Then again it is dipped in a separate vessel of water mixed with 2 tolas of copperas or sulphate of iron and dried. $\frac{1}{4}$ lb. of catechu is then broken and put in a jar of water, which is left untouched for one night. In the morning the catechu water is stirred and 2 tolas of thin lime are put in it. The cloth is twice dipped in this mixture and dried in the sun each time. It is then washed with pure water and dried for the last time. In Hyderabad (Sind) cloth is dyed dark brown by being first dipped in a decoction of tamarisk berries and then in a jar of water in which about 8 oz. of rusty iron and half that quantity of *juari* flour (*Sorghum vulgare*) have been allowed to stand for a week or more, being repeatedly stirred. This colour is known as rust-colour, though in reality it is considerably darker than what is generally understood by that name. In the Upper Sind Frontier a *khaki* colour is similarly obtained, with the exception that a solution of $\frac{1}{2}$ lb. of sulphate of iron is used instead of the iron liquor. Babul pods are also reported to be employed sometimes in place of tamarisk galls; while a wash in alum water is always given to make the colour fast. A brownish green or pulse colour, locally known as *mungo*, is thus produced in Shikárpur. For 6 yards of cloth $\frac{1}{10}$ seer of tamarisk galls is ground down. The cloth is then dipped in this with sufficient water to thoroughly wet the cloth, which assumes a *khaki* or brown colour. $\frac{1}{2}$ seer of the flowers of the cotton plant is dissolved in water, which is then boiled and filtered. The cloth in its above condition is dipped into the filtered water and afterwards dried in the sun. $\frac{1}{10}$ seer of alum is then ground and put into clean water. The cloth on being dipped in this becomes the required colour. A similar process is followed in the Upper Sind Frontier, with the exception that pomegranate rind is dissolved with the cotton-flowers in boiling water.

The following are other shades of brown, black and grey, in which the *Nírolis* of Shikárpur dye cloth, with their English equivalents and principal ingredients:—

Sindhi name.	English equivalent.	Ingredients.
(1) Saliz khaki.	Greenish brown.	Pomegranate rind, copperas, cotton-flowers, potash alkali.
(2) Shutri.	Camel colour.	Pomegranate rind, copperas, alkali.
(3) Wanguai.	Deep red colour.	Babul pods, copperas, ajaib (a reddish yellow) colour.
(4) Shakri.	Sugar coloured, creamy white.	Pomegranate rind, copperas, alkali, fuller's earth.
(5) Zamurdi.	Diamond white.	Pomegranate rind, copperas, indigo, alum, cotton-flowers.

In the Shikárpur Prison cotton-cloth is dyed a dark *khaki* colour by steeping it first in a solution of turmeric or *guljalil* (*Delphinium* species) and alum, and then in one of catechu, *papaikkhar* and slaked lime. Cotton yarn is similarly dyed the same colour, but undergoes a preliminary steeping in a decoction of pomegranate rind and a solution of copperas. The *khaki* may be made of different shades by increasing or decreasing all or any of the three ingredients, viz., (1) copperas, (2) turmeric and (3) catechu, *papaikkhar* and lime.

C.—KASUMBA OR SAFFLOWER DYEING.

Almost an entirely separate branch of the dyeing industry is the *kacha* dyeing of turbans, scarves, *rumals* and other cotton cloths with *kasumba* flowers, the dried florets of the safflower or *kardai* plant, known botanically as the *Carthamus tinctorius*.

This occupation, as already mentioned, is, as a rule, followed by a distinct class of dyers, and prevails in almost every district in the Presidency, even in districts like Thána and Kolába, where (probably owing to their proximity to Bombay) no other dyeing is carried on. Though a beautiful red, safflower fades quickly and does not bear washing. As it has no affinity for any known mordant, it cannot be made fast. The crop comes to market in February and March. In this Presidency it appears now to be grown only in small quantities in Gujarát, chiefly Ahmedabad and Kaira Districts, but the product is said to give the best deep colour of the four varieties on the market. That used in the Deccan is said to be grown in the Berárs and the neighbouring parts of the country and to be imported by rail *via* Bársi road and other convenient railway stations. The price of *kasumba* at Poona varies according to its quality from Rs. 40 to Rs. 60 per *palla* of 3 maunds or 120 seers in weight. The *Rangaris* make their purchases in *pallas* according to requirements and keep the flowers in gunny-bags in their houses.

A safflower-dyer's only appliances are a few copper pots and a few stool-like frames, with a piece of coarse cloth tied over the top of each to form a strainer, *jholi*. This consists of a square stand with four legs to which the straining cloth is attached. Below it is placed a large earthen pot or *kundi*, called in the Deccan *jardai*, into which the filtered liquid passes. To extract the red dye from the flowers the following is the process usually followed :—

(1) Sufficient *kasumba* flowers are taken from the bag (*e. g.*, for one turban about 5 lbs.) and well ground and pounded to powder.

(2) This is dissolved in about an equal quantity of water, and the mash or pulp so obtained is placed in the straining bag.

(3) Water is poured over the flowers from time to time with a pot like a kettle, until the yellow dye contained in them and all the impurities have been removed. For 5 lbs. of *kasumba* flowers, about 10 or 15 lbs. of water will be thus gradually poured through the strainer. At first the liquid which oozes through and collects in the pot below will be very dirty and discoloured; but gradually the liquid becomes purer, and when clear water begins to leak through, the *Rangari* knows that all impurities have been removed. This process takes some time—in Poona nearly 12 hours, while in Ahmednagar it is said the straining goes on for a day or two. This careful straining is necessary, because the presence of the yellow dye is injurious to the red one and the florets must accordingly be quite freed from it. In Khándesh, however, the whole process is said to take only 3 hours altogether: a great deal would seem therefore to depend on the degree of purity required. The yellow dye which is extracted is sometimes used for giving a bath to turbans, which are to be dyed green or yellow; otherwise it is generally thrown away.

(4) The flowers are then taken out of the *jholi*, and either pressed and squeezed with the hands or feet in a cloth, or spread in a piece of cloth and pressed with a wooden plank to remove any impurities which may have survived the straining process.

(5) Now comes the extracting of the red dye: for this the addition of an alkali is necessary. After being squeezed and pressed as above, the *kasumba* is spread in a very thin layer on a cloth to dry. When fairly dry, a small quantity of powdered *sajekhar* or *papadkhar* (impure carbonate of soda) and ordinary salt—about $1\frac{1}{2}$ tolas of each to 1 lb. of *kasumba*—is added; and they are well mixed together either in a cloth or on a wooden tray by pounding and pressing. The mixture is put in the straining bag and treated as before with some 10 or 15 lbs. of water, which is gradually poured over it, with the result that the red colouring matter drips through into the pot below.

*Chunam or quicklime may also be used.

(6) Some lime juice (in Khândesh the juice of 25 lmons per scer of *kasumba*) or a *decoction of sliced and dried unripe mangoes are then added to give acidity to the solution and thereby precipitate the red carthamic acid or carthamin, which is the colouring principle of the red dye. This has the effect of settling the colouring matter at the bottom. The almost colourless water which comes to the top is removed and put into another vessel. The lower stratum of colouring matter is called *jetha* and is the base from which all the colours in *kasumba* dyeing are obtained. The former liquid is made use of in washing turbans before they are steeped in the latter. The quantity of *jetha* required for dyeing a turban varies according to the depth of colour required. From 15 lbs. to 1 lb. may be used in dyeing one turban, but 5 lbs. is the ordinary quantity.

Kasumba flowers of good quality should yield *jetha* in the proportion of 4 to 2 or 1½.

Before being dyed, the turban or cloth is generally washed by the *Bangari* as follows. It is first dipped into the yellow discoloured liquid obtained from the *jholi* as above described, then taken out and squeezed and again dipped in the *kund*, after some lemon juice has been added to the solution. The process is repeated some four or five times at the least; occasionally it is done more than 20 times, *e.g.*, when a turban already coloured red has to be re-dyed, and it is necessary to remove all the impurities which have accumulated. When it has become clean enough, the cloth is dipped into the *jetha* solution and kept there for about 15 minutes. It is then taken out and after lemon juice has been added to the remaining *jetha*, is again dipped in it. The cloth is turned over and over in the solution and treated in this way for about 1½ or 2 hours until the whole of the colouring matter has been absorbed, leaving the liquid in the pot almost colourless. Another solution of *jetha*, lemon juice and wheat paste is then prepared and the cloth kept in this for some time. This is done to starch the cloth and make the dye more lasting. Finally the fabric is squeezed and dried in the sun. The use of lime juice in the dyeing process is to brighten the colour.

Various shades of red, pink, yellow, orange, green, purple, and black are obtained by varying the proportions of the constituents of the *jetha* solution, and combining the latter with the use of turmeric, myrobalans, indigo, and other vegetable dyes. The following are the main colours obtained and the methods of producing them:—

(1) *Red*.—*Kasumbi*, safflower-red, is produced exactly as described above and is the natural colour of the *kasumba* dye. If a darker shade of red is desired, the cloth is first treated with a solution of turmeric before being dyed or is immersed again in the *jetha*, when it takes another coat of colour and becomes deep red. On the other hand, the shade may be lightened by diluting the *jetha* with water or keeping the cloth in the solution for a shorter time.

Pyaji (onion colour) and *gulabi* (rose colour) are shades of pink. The same process is observed exactly, with the exception that a smaller quantity of *jetha* is used. *Jetha* is used for *pyaji*, *gulabi* and *kasumbi* in the proportions respectively of one, two, and four. In Ahmedabad it is said that pink is produced in the same way as red, but the lemon juice or mango solution is used a third time. Other shades of red similarly obtained are known respectively as *gulabi gehera* (deeper rose colour, magenta), *atasi* (fire-red, cerise) and *motiya* (jessamine or flesh colour), the first two requiring more *jetha* than *gulabi* and the last one less. In Shikárpur two further dyes are reported to be produced, *viz.*, *sonabni* (golden) and *gulzar* (deep red). Both are prepared with turmeric, safflower and alkali; but the latter also has lemon juice as one of its ingredients.

A crimson dye is sometimes produced, *e.g.*, in Thána and Násik, by steeping the cloth in the *jetha* solution and then in a boiling water solution of cochineal and galls to which lemon juice is added.

* In Ahmedabad this is prepared and used as follows:—1½ lbs. of dried mangoes are dissolved in 2 lbs. of water. 1 lb. of this is used for the quantity of *kasumba* extract obtained as above, and the rest is used when the turban is steeped in the dye in proportion to the quantity of the latter used.

(2) *Yellow*.—The dye used, as in other dyeing, is turmeric, and sometimes, though rarely, saffron. The following is the process generally followed for dyeing a turban yellow. Prepare a solution of $\frac{3}{4}$ lb. of turmeric and 3 lbs. of cold water, steep the article in it for half an hour, then take it out and in its drenched state steep it for 5 minutes in a solution of lemon juice or dried mangoes. Then take out the article and dry it. Sometimes a light solution of *jetha* is added to the lime juice one to give it a slightly orange shade. The cloth is afterwards starched with a paste of wheat. A bright yellow (*basanti* or *limbodi*) may be obtained by first steeping the cloth in an alkaline solution of turmeric and then passing it through a solution of alum. In Broach *chunam* is added to the turmeric solution in the proportion of 4 tolas to 1 seer of the latter; and the cloth after being dried is dipped in an alum solution.

(3) *Blue*.—As for other cloth-dyeing, indigo dye is used; but the same care is not taken in its preparation. In Khándesh it is reported to be prepared as follows. Fifteen or twenty chatties of water are poured into a small *chunam*-plastered cistern. One seer of indigo and half a seer of lime are added together with one seer of *jagari*. After 4 or 5 days the liquid becomes blue and the dye is ready. In Thána, however, the process resembles that followed in other cloth dyeing and takes about 8 days. The cloth after being well washed is steeped in the dye for about $\frac{1}{2}$ hour and then taken out and dried. If a reddish tinge be desired, the cloth is also dipped in the *jetha* solution.

(4) *Black*.—This is generally obtained by dyeing with indigo as above, the cloth being afterwards treated with a solution of *jetha* and starched with wheat paste. Turbans are, however, sometimes dyed black by steeping in water mixed with $\frac{1}{2}$ seer of copperas (*hirakas*) and an equal quantity of myrobalans for one seer of cloth, as in ordinary cotton-dyeing. This process is repeated five or six times, the turban being dried in the sun between each immersion.

(5) *Brown*.—Turbans, &c., are not generally dyed brown by *kasumba* dyes. In Ahmednagar, however, it is reported that *khaki* or brown and grey hues are produced by first soaking the fabric in *hirda* (myrobalan) water in which a decoction of the bark of the babul tree (*Acacia arabica*) and some salts have been previously mixed.

(6) *Purple*.—In Kaira, the cloth is first dyed blue with indigo, and then while wet steeped for about a quarter of an hour in the *jetha*, to which a solution of lemon juice and water is then added. After the article has been kept in this for 5 minutes, it is taken out and dried. In Poona and other places the cloth is dried after being dyed with indigo, and is then dipped in a solution of *jetha* and lemon juice as many times as is necessary for the desired shade of colour. The colour called *kirmazi* (cochineal-red or crimson) is obtained by the reverse process of first steeping the cloth in the *kasumba* dye and then in the indigo bath.

(7) *Green*.—This colour is generally secured by giving the cloth successive baths of indigo and turmeric, it being afterwards washed with the light yellow solution first strained from the *kasumba* flowers through the *jholi*. In Kaira pomegranate rind is added to the turmeric bath for the purpose of fixing the colour, the process being as follows. Prepare a solution of $\frac{1}{2}$ lb. of indigo and 5 lbs. of water. Prepare also another solution of a mixture of $\frac{1}{2}$ lb. of above, $\frac{1}{4}$ lb. of pomegranate rind, $\frac{1}{2}$ lb. of turmeric and 5 lbs. of water. First steep the article in the indigo solution for half an hour, and take it out and dry it. Boil the compound solution, and when cold, steep the article in it for 5 minutes. Then take it out and dry it. In Broach a small quantity of lime is added to the turmeric solution, and the cloth is afterwards passed through an alum bath.

(8) *Orange*.—The cloth is first dipped in an alkaline solution of turmeric, then in the *jetha*, and finally treated with weak lime-juice. According as more or less of the *jetha* is used, the shades known respectively as *narangi* (orange) and *gulnar* or *gul-i-anar* (like the pomegranate flower) are produced. Another shade called *soneri* or *sonilal* (golden yellow) is obtained by using more turmeric. In Broach and Ahmedabad

the turmeric is added to the *kasumba* solution in the proportion of 1 to 20. A solution of myrobalaus (*hirdlas*) is sometimes used instead of one of turmeric, *e.g.*, at Ahmednagar; and a similar use is made of *shali* flowers (*Nyctanthes arbor-tristis*) in Kaira, where they are said to be grown in gardens though a large proportion of the flowers are imported.* The dye is fleeting and with *kasumba* produces the shade of orange known as *gulmar* or saffron. The process is described as follows;—Prepare a solution of 10 lbs. of water and 2 lbs. of *kasumba* flowers and strain it, steep the article in it for half an hour and then take it out. Prepare a solution of $\frac{1}{2}$ lb. of the stems or yellow tubes of *shali* flowers and 1 lb. of cold water and boil it. When it gets tepid, steep in it the article drenched in the first solution and while it is wet; then add to it $\frac{1}{2}$ lb. of lemon juice and steep the article in the mixture for 5 minutes. Then take it out and dry it.

It must, however, be mentioned that even *kasumba*-dyers have forsaken the native vegetable dyes for imported ones to a considerable extent, and in Ahmedabad it is estimated that about half the quantity of turbans dyed red are dyed with *kasumba* and the rest with aniline dyes, while for about one-eighth of the turbans dyed green, yellow and blue, aniline dyes are used.

III.—Silk-dyeing.

Although silk-dyers were returned at the census of 1891 as numbering only 1,353, of whom about half were females, still this by no means represents the real number of dyers who are engaged in this occupation. Large numbers whose principal business is that of cotton-dyeing and who would be so returned at the census, also engage in silk-dyeing; and again many silk-weavers, like the Christian *Khatris* of Thána, also dye the silk-yarn before it is woven. The chief centres of the silk-dyeing industry are Bombay, Ahmedabad, Surat, Yeola, Málegaon, Násik, Poona, Ahmednagar, Belgaum, Dhárwár, Bijápur and the Karáchi, Hyderabad, and Thar and Pákar Districts in Sind. The castes mainly engaged in the business are *Kunbis*, Mussalmans, *Gulíaras* and *Khatris* in Gujarát; ordinary *Rangaris*, (either *Marathas*, *Khatris* or *Bhavsars*) as also *Thakurs*, *Bohoras*, *Pardeshis*, *Mussalmans* and *Momins* in the Deccan; *Patvegars* in the Karnatak; and *Patolis* in Sind.

The silk dyed comes as a rule either from China, Bengal or Persia, and for trade purposes is divided into about six classes according to quality, with prices varying from about Rs. 20 to Rs. 2-8 a seer. By far the larger quantity used is *Chínai*, imported from Hong-kong and the Trading Ports. In 1894-95, out of a total of 2,337,855 lbs. of raw silk imported into the Bombay Presidency, 2,089,483 lbs. were so imported of an aggregate estimated value of Rs. 89,82,589. Only 14,371 lbs. were imported by sea from Persia, of an estimated value of Rs. 61,009. In Karáchi "*Chínai*" raw silk is sold for about Rs. 11 a seer, while the "*Tuni*" silk from Khorasan in Persia fetches Rs. 20 a seer. Bengal silk is generally of two kinds, the prices varying from Rs. 13 to Rs. 10 a seer according to the quality. The raw silk is sold unbleached in skoins. The dyed silk is chiefly made up into women's garments such as *paithanis*, *soolis* and *lugadis* or used in edging cotton robes. As a rule the raw silk is dyed before the articles are manufactured, but in some places, *e.g.*, Ahmedabad, woven silk cloth is also dyed, or more commonly printed by a curious process called *knot-dyeing*.

The chief colours in which silk is dyed are red, pink, yellow, orange, green, purple and black. Silk used in making clothes is generally dyed with indigenous dyes, especially when dyed red, pink or yellow. These are preferred in the case of silk-dyeing to aniline or alizarine dyes, because these latter fade soon and in the case of some have a detrimental effect on the silk thread, rendering it weak and liable to give way under the least tension. For other colours European dyes are however chiefly used, as native dyes are not easily available; and it is estimated that aniline dyes are used for about one-fifth of the silk and silk cloth dyed at Ahmedabad.

* Dr. Liotard's Memorandum on Dyes of Indian Growth and Production, page 59.

Generally the dyer is paid a fixed sum according to the quantity of silk dyed and the colour with which it is dyed. Thus in Poona the charge for dyeing silk with European dyes varies from 5 to 7 annas per 2 lbs., which includes the cost of the dyes used, labour, &c. For indigenous dyes, which are preferred as giving faster colours in silk-dyeing than aniline, the charges are higher, viz., Rs. 2 per 2 lbs. for red or pink, Rs. 1-8 for orange or yellow, and Rs. 1 or Rs. 1-4 for other colours. In Surat, where a large amount of silk-dyeing is carried on, a curious system is reported to prevail whereby the dyer receives only a portion of the real charge and is supposed to make up the rest by stealing silk. Thus the charge for dyeing half a maund (Surti) of silk red is nearly Rs. 8, but the dyer receives only Rs. 4 in cash and makes up the deficiency by returning to the owner only 15 seers (Surti) of the half maund of undyed silk which had been weighed out to him. On an average it takes 9 persons to prepare $\frac{1}{2}$ maund of red silk in a day, and the dyer has to spend about Rs. 1-10 on the cost of materials used by him, such as firewood, *sajikhar*, lime water, alum and turmeric, while the colouring matter is supplied by the merchant who gives the silk for dyeing. Similarly the charge for dyeing silk green is Rs. 10 per $\frac{1}{2}$ maund. The cost of the materials used will in this case be about Rs. 8, but here again the dyer makes about Rs. 2 by stealing silk. In indigo-dyeing the nominal charge is Rs. 25 per $\frac{1}{2}$ maund, out of which the owner of the vat gets Rs. 18 and Rs. 2 towards the cost of firewood and *sanchora* (alkali), with the result that he manages to make a net profit of Rs. 5.

There are three large Mahomedan silk-dyeing establishments in Karáchi where 100 men are employed at from 6 to 10 annas a day, and 10 small Hindu shops where about 50 men work on similar wages. There are also 6 or 7 shops where the printing of patterns is done, and in them some 20 to 25 men work at a regular wage of Rs. 15 to Rs. 16 per mensem. In Tatta on the river Indus in the same district there are eight silk-dyeing establishments with some 20 to 30 Hindus working in them. The details given for other districts are very meagre.

The necessary articles for silk-dyeing merely consist of a brick and mud fireplace, four large pans or *patelis*, one large pot for boiling silk, one *pata* or stone-slab, one grinding stone and some long iron-tipped pestles. For indigo-dyeing the ordinary vats are also required.

The process of bleaching raw silk is not so lengthy or so elaborate as in the case of cotton. In the Bijápur and some other districts this is done simply by boiling the silk thread in hot water, and after it has been dried in the sun

fumigating it with sulphur, probably on somewhat the same principle that wool or silk is bleached in Europe by what is technically known as "stoving" it with sulphurous acid, produced by simply burning stick sulphur in a stove or small brick or stone chamber. The process more generally followed is, however, that of steeping the

silk in a solution of lime and soda or potash, which besides its bleaching properties produces sheen and softness. Thus in Ahmedabad and Surat the silk is treated as follows, the quantities given being sufficient to bleach and dye 40 lbs. of silk. About 10 lbs. of *kharo* (carbonate of soda) and 20 lbs. of lime are dissolved in 80 lbs. of water. After about a quarter of an hour, the sediment settles down and a clear liquid comes to the top. This is taken out and put to boil. When it is well boiled, the silk is steeped into it. Cow-dung cakes are used for boiling the water in order to regulate the heat. A portion of the silk is now and then lifted up and rubbed between the fingers; and when it is found to be quite free from starch or size, it is removed and immediately taken to the river, where it is washed and then brought home.

Five lbs. of alum are boiled in 4 or 5 lbs. of water, and the solution mixed with 1 or $1\frac{1}{2}$ maunds (40 or 50 lbs.) of cold river water. The silk is then steeped in it. It is allowed to remain in the water in an earthen vessel the whole night. The next morning it is

squeezed, taken to the river and there washed. It is then ready for dyeing. After being dyed, the silk is generally taken to the river, washed and dried on bamboos.

In Sind the process followed seems to differ in some respects. Thus in Karáchi, 1 seer of raw silk is kept in 4 seers of water with a seer of potash, for one night. Next morning the mixture is strained, and the strained water put into a kettle and boiled. The silk is then spread over pieces of wood, so as to let it dip in the water, and is turned on the sticks every 3 or 4 minutes, so that it is all gradually steeped, after which it is taken out, wrung and dried. The silk is next mordanted in a solution of alum when it is ready for dyeing.

(1) Red.

For dyeing silk red, cochineal, or the colouring matter obtained from the female of the insect called *Coccus cacti*, is universally used on this side of India. Though in England its use for silk-dyeing has at the present day been almost entirely superseded by the coal-tar colours, in India it is, for reasons which have been stated above, preferred to the latter; and, as before mentioned, galls formed on *pista* or pistachio nuts (*Pistachia vera*) are used as a mordant in preference to myrobalans or other galls, because they are supposed to give better tints to the silk. These and the cochineal are powdered or ground together in proportions varying from $\frac{1}{4}$ to $\frac{3}{4}$ of pistachio nuts to 1 of cochineal. Thus in Ahmedabad the process followed for 40 lbs. of silk is as follows. 15 lbs. cochineal and 11 lbs. pistachio galls are ground together. The whole quantity is then boiled in 20 or 25 lbs. of water. About 60 lbs. of cold water is then added to the boiled water, and immediately the wet silk brought from the river is steeped in it, taken out and squeezed. The water is then again boiled, and when boiling the silk is steeped in it and allowed to remain until the water appears colourless. At the most it remains in the boiling water for $1\frac{1}{2}$ hours. The silk and water are then transferred from a metal vessel to an earthen vessel and kept for the night. In the morning the silk is taken to the river, washed and dried on bamboos. Sometimes $\frac{1}{2}$ lb. of turmeric is mixed with the powdered cochineal and pistachio nuts in order to make the colour somewhat lighter in shade; and in Poona the silk is said to be dyed red, without the use of pistachio galls, by being boiled first for about half an hour in a solution of turmeric and water with 30 tolas of turmeric for every seer of silk. The resulting dye cannot, however, be a fast one, as it is said that the silk, if dried in the sun, loses its colour. Pistachio galls are used at Poona for dyeing silk the shade of red called *gulabi*.

(2) Yellow.

Silk may be dyed this colour with turmeric, as at Ahmedabad, where 30 lbs. of turmeric is boiled in water and the bleached silk is immersed and allowed to remain in it for the night. More ordinarily, however, at least in the Presidency proper, *kapila* powder, or the reddish yellow powder which covers the ripe fruit of the *Kamila* tree (*Mallotus philippensis* or *Rottlera tinctoria*), is used for dyeing silk. This is a common tree throughout the Konkan, Ghats and Southern Marátha Country; and the powder which is brushed off and collected wants very little preparation before being used, all that is needed being to mix it with water holding in solution half its weight of carbonate of soda. Silk dipped in this assumes a fine golden or orange colour, and carbonate of soda and alum are generally added to the solution of *kapila*, in which the silk is boiled. The process, as followed at Thána, is to twist the bleached silk into a bundle and tie a string to it. It is then put into a boiling solution of—

<i>Kapila</i>	...	...	...	2 oz.,
<i>Papadlhar</i>	...	...	...	$\frac{1}{2}$ lb.,
Water	...	...	...	2 gallons,

to which, after about 15 minutes, 2 oz. of powdered alum is added. The mixture, after being allowed to boil for 15 minutes more, is taken off the fire-place to cool, when the silk is taken out, washed in cold water and hung up to dry. This gives a lasting dye, but the process requires close attention.

In Poona, Surat and some other places, silk is dyed a lemon-yellow with a solution obtained from the flowers and stalks of a kind of grass. (*Delphinium zaili*), which is said to be imported from Persia, Cabul and Beluchistan. It is called in the vernacular by its Persian name of *gulijalil* or *guljalil* and *asparag* or *isparek*, but in the bazar it is generally known by the corrupted word **Hubarak*. It can be had in Poona at any Gujarati Bania's shop at 6 or 7 annas a seer. To extract the colouring matter about 2 lbs. of *isparek* is boiled in 2 gallons of water and then strained. The silk after being bleached is soaked in a gallon of cold water containing $\frac{1}{4}$ tola of alum. It is then steeped in a boiling solution of the dye and impure carbonate of soda. Though itself colourless, this solution gives the silk a yellow that does not fade by exposure to the sun. Sometimes the silk is also passed through a hot solution of turmeric, either before or after the steeping in *isparek*.

Aniline dyes are also used for dyeing silk and silk-cloth. The general process is to dissolve the dye in cold water; the silk is then immersed in this solution for about half an hour, when it is taken out and dried. In Bijapur the aniline dye or, as it is generally called, *kuppi* powder is dissolved in a mixture of oil, and equal quantities of potash and lime.

(3) Blue.

Silk is seldom dyed blue, but when it is wanted, it is generally sent to an indigo-dyer. The latter keeps for the purpose a sweet vat, *mitha pip*, in which indigo of a superior sort is used, as opposed to the salt vat, *khara pip*, used for dyeing cotton. The preparation of the former differs, however, but little from that of the latter. The following is the general method. 120 gallons of water are poured into the vat, 4 lbs. of carbonate of soda are added and the whole is kept covered for three days. On the third day, 4 lbs. of carbonate of soda and 2 lbs. of lime are added, and the whole is stirred three times a day. Next morning, the fourth day, 4 lbs. of old brown sugar are dissolved in cold water, and the solution is thrown into the vat, and the whole is occasionally stirred for three days more. When fermentation sets in, the mixture begins to crackle. At this stage the foam is examined, and, if it is reddish, the vat is in working order. If the foam is white, 3 lbs. of carbonate of soda and an equal quantity of lime are added to the vat and stirred. The proportions of lime and brown sugar in the vat require nice adjustment; if this is not properly attended to, the indigo rots, smells horribly and is unfit for dyeing.

In Surat the indigo vat for silk is prepared with boiled aloes (*kunvario*) and *sajikhar* in the following proportions:—

Indigo	...	...	...	$\frac{1}{2}$ maund Surti.
Aloes	...	...	...	$1\frac{1}{2}$ " "
Sajekhar	...	...	...	$1\frac{1}{2}$ " "

The vat is kept closed for seven or eight days, being stirred twice a day, until fermentation sets in. The silk is then dipped into it and kept in constant movement to ensure full access of colour to all parts. The time required for dyeing varies from twenty minutes to two hours.

Aniline blue. For other shades of blue, e.g., *parva* or blue-pigeon colour, aniline dyes are generally resorted to.

(4) Black.

Silk is sometimes dyed black at Poona and Násik with sulphate of iron (*hirakas*). It is first steeped in an infusion of myrobalans (*hirdus*), then for a night in a solution of sulphate of iron, then squeezed, steeped either in cocoanut oil or cocoanut milk, boiled again in a solution of sulphate of iron, and, when cool, washed in plain water. In Ahmedabad a sort of black colour is obtained by steeping red-dyed silk in a strong indigo bath.

* At Thána it is also known as *Trayaman* or *Traman*.

(5) *Purple.*

This, as in the case of cotton, may be produced by dyeing red silk either with indigo or with sulphate of iron, after a preliminary steeping in an infusion of myrobalans. In Bijápur it is dyed with a purple aniline dye and cochineal, and a similar use is made of aniline dyes in other districts. Another way of making a purple fabric is, in weaving, to use black silk for the warp and red for the weft.

(6) *Green.*

This may be obtained by giving an indigo bath to silk dyed yellow in the way described above; or the process may be the reverse, as in Ahmedabad, where blue-dyed silk is steeped in a turmeric bath, 30 lbs. of turmeric being used for 40 lbs. of silk. In Bijápur *kakadsingi* (*Pistachia integerrima*) are used with turmeric, the silk, which has been dyed blue with indigo, being boiled in this solution. In Sind silk is dyed green—like cotton—by successive steepings in infusions of pomegranate rind, indigo, turmeric and alum. As a rule, however, aniline dyes are now preferred for this colour, and in Dhárwar the green *kuppi* powder is combined with *kapila* powder (*Mallotus philippensis*).

(7) *Orange.*

This shade is obtained from *kapila* powder with the help of *papadkhar* and *chunam*. The ordinary *keshri* or saffron colour is, however, produced by boiling the silk in a dye-beck, containing, in addition to cochineal and pistachio galls, a variable quantity of turmeric. The proportions of the orange dye mostly used at Yeola in Násik are 17 of cochineal, 7½ of pistachio galls, and 34 of turmeric. In Poona silk is dyed *narangi* or orange by treating it with *kasumba* or safflower extract, with which a smaller quantity of lemon-juice and *sejekhar* than usual is mixed, after the silk has been dyed yellow with *ispurek*. Aniline dyes are also in common use.

(8) *Brown, Grey, &c.*

Silk does not appear to be often dyed in these colours. In Násik, however, it is said to be dyed a snuff-colour by being steeped in a decoction of *babul* (*Acacia arabica*), *khair* (*Arabica catechu*), and catechu powder.

(9) *White.*

This may of course be effected by simple bleaching. But to secure a purer white, the process of what is known as “blueing” should be resorted to. The unprepared silk-yarn has a yellowish colour, which is effectually masked by the use of some substance which will tinge the cloth with its complementary colour, viz., blue of a slightly violet tint. This is probably the explanation of the following process for dyeing silk white, which is reported to be used by the Thána *Khatri* silk-weavers and dyers. If one *rattal* (1 lb.) of silk-yarn be taken for dyeing, two gallons of water are put in a pot with some Bengal indigo in a small cloth bag. This is rubbed against the surface of the pot in the water, until it takes a somewhat black tint. Afterwards 2 oz. of *papadkhar* and 6 oz. of country soap are put in the water, which is then boiled. The silk-yarn, after being twisted into a bundle with a string attached to it, is steeped in the boiling mixture, and after some time is taken out, washed in fresh cold water and hung up to dry.

IV.—Wool-dyeing

Wool-dyeing is carried on to an extremely small extent in this Presidency and at the census of 1891 only 93 persons were returned as engaged in this branch of the dyeing industry, distributed as follows:—

Ahmedabad ...	...	...	...	...	51 males.
Surat...	...	...	...	...	7 do.
Khánder-h ...	...	...	...	...	24 females.
Sátára ...	...	...	...	...	8 males.

These figures cannot, however, be considered very reliable, on account of wool dyeing, where it is practised, being as a rule carried on with some other principal occupation, to which that of wool-dyeing is subsidiary. Thus the Collector of Karúchi notes that the dyers of wool in that district are really the

carpet-makers of Bubak, who use coloured wools in the manufacture of their *ghalichas*. Mention is also made of the wool used in making the prettysmall house-mats or prayer-carpets, which are manufactured in Hyderabad (Sind), being dyed with aniline dyes, after being first bleached in an alkaline solution. Elsewhere, with the exception of a few in Bombay and Ahmedabad and one or two other places, the industry appears to be almost entirely confined to the Government Jails at Yerrowda, Ahmedabad, Thána, Karáchi and Shikárpur, where wool twist is dyed for making up woollen carpets.

The following few details relate entirely to the dyeing of wool, as there practised, on partly European and partly native methods. The wool is first bleached by being steeped in water, flagged with sticks, well washed, and wrung several times. In the Karáchi Jail, it is first soaked for 12 hours in a solution of lime and potash; while in the Yerrowda Jail, it is regularly bleached with various cleaning agents, such as ammonia, carbonate, bleaching powder, caustic soda, carbonate of soda, pearl-ash, washing soda, *chunam* and *country* and English soaps, or merely immersed in a lye of soap, pearl-ash, carbonate of soda and lime-water, according as the wool is to be dyed a light or dark shade.

Wool is dyed in warm or hot solutions varying from 119° to 212° Fahr.

The mordants employed are alum, protochloride of tin, oxalic acid, sulphuric acid, red spirits (prepared with nitric acid, muriatic acid and granulated tin) and plumb spirits (prepared with nitric acid, muriatic acid and crystal tin).

The following are the chief European and Native materials used for dyeing wool:—

European.

Vegetable.	Animal.	Mineral.
Archil. Argole. Cudbear. Fustic. Logwood. Sumach.	Carmine. Cochineal. Soaps.	Acid, Sulphuric. Do. Nitric. Do. Muriatic. Do. Oxalic. Do. Tartaric. Ammonia Carbonate. Carbonate of Soda. Chrome (Bicarbonate of Potash). Crystal Tin. Caustic Soda. Protochloride of Iron. Pearl-ash. Cream of Tartar.

Native.

Vegetable.	Animal.	Mineral.
Gall-nuts. Guljaleel. Indigo. Jagri. Lac. Munjit. Tamarind. Til oil. Babul-bark. Pomegranate rind. Turmeric. Kapila. Pallas flowers.	Cochineal.	Alum. Chunam. Salt. Sulphate of Iron. Sulphate of Copper. Sajikhar.

The wool is dyed in some 30 different shades and colours by a combination of these various ingredients, but as the actual process of dyeing is based more on European than native principles of dyeing, a description of them would be altogether outside the scope of this Monograph, and would take up a space quite out of proportion to its importance, having regard to the very limited scope of the industry in this Presidency. The following methods of making the pre-

Murabba and *Tejab*. preparations called respectively *murabba* and *tejab*, which are used by native dyers in dyeing nearly all shades of blue and red, may, however, be usefully mentioned.

Murabba.—To make 5 lbs. of this, take—

Indigo (best quality)	...	...	...	...	1 lb.
Sulphuric acid	...	...	...	...	4 lbs.

Reduce the indigo to a very fine powder, and mix it gradually with the acid until the whole takes the consistency of honey. Great pains should be taken in preparing this. If the powder be coarse or the mixing done imperfectly, the *murabba* will contain lumps and will greatly affect the dyeing. Nor should too large a quantity of this be prepared, as it is apt to get spoiled. *Murabba* is also sold ready made in the bazars at about 4 tolas per rupee.

Tejab.—To make 3 lbs. of this, take—

Saltpetre	...	...	...	6 lbs.
Copperas	...	...	...	3 "
Red Alum	...	...	...	1½ lb.
Salammoniac	..	...	...	12 oz.
Arsenic ...	...	...	...	1½ tolas.

Pound the whole fine, mix thoroughly and divide into three equal parts. Put one part into a well-baked earthen pot with a small mouth, and fit it to an empty large-mouthed pot. When the pots are fitted together, place the one containing the articles above named on the oven, while the one fitted to it should not be exposed to the direct heat of the fire. Then cover the mouths and necks of the pots with mud, so as to have them steam-tight. As the heat increases and the articles dissolve, so the steam will enter the opposite pot which is not directly under the influence of the fire. The latter pot should be kept cool by cold water being put over it from the trough with a large rag. The water from the trough should be renewed as soon as it becomes hot. The condenser will heat as soon as the steam enters, but when it begins to cool, it must be understood that the distillation is decreasing; and when tolerably cool, the pots may be removed as the process of distillation will have ceased. This process occupies about 1½ hours.

The quantity is decreased to one-third as shown in the first part of this experiment, because an ordinary earthen pot will not stand sufficient exposure to fire to do the whole quantity at one time.

The earthen pot used as the boiler should be thrown out and a new one taken every time the distillation is repeated.

V.—Block-printing.

(i) *Calico-printing* is very extensively practised throughout the Bombay Presidency. It is true that in the census of 1891, only 5,097 persons, of whom about half are females, are returned as cotton calenderers, fullers and printers; but this does not anything like represent the real number engaged in this industry, as may be judged from the fact that 1,100 out of these are returned from Ahmedabad, and 825 from Bombay, Broach, Khandesh and Nasik, leaving some 200 only for the rest of the Presidency. As a rule, except in indigo and *kasumba*-dyeing, calico-printing goes hand in hand with ordinary cotton-dyeing; and a large number of those returned as cotton-dyers are also cotton-printers. In Gujarāt calico-printing is carried on by *Chipas* and *Bhavsars*; but not as a rule by *Khatris*, who devote themselves to plain dyeing. In Sind, however, they do both. The Sind cotton-printers are reported to be the most skillful and tasteful in the Presidency, those of Dhārwar ranking second. In both places the goods decorated are large sheets

(*razais*) used as bed coverings, wall-hangings, and floor and ceiling cloths, and sometimes as clothing in cold weather. The best cotton robes (*saris*) are said to be printed in Gujarát (chiefly Ahmedabad, Surat and Broach), where such goods are extremely popular. The printing is effected by means of small

rectangular wooden blocks or dies with handles attached to enable them to be applied to the cloth in exactly the same way as an office seal. The face of one generally measures 4 x 6 inches or thereabouts. These wooden dies are usually carved out of teak (*Tectona grandis*) or *khair* (*Acacia suma*) wood by a local *Sutar* (carpenter). In Belgaum the blocks are said to be made of *hasan* (*Bridelia retusa*) wood and the designs to be carved by men of the *Jingar* caste. In some places, e. g., in Khándesh, they are made by the printers themselves, who in cutting them use from 40 to 50 small sharply pointed steel nail-like tools. The printer who makes these stamps generally does no other work. He has a stock of patterns drawn on paper, and sometimes, though rarely, supplies new devices. From the paper pattern a drawing in ink or other coloured substance is made on the face of the wooden block and the pattern is afterwards cut to the required depth. This is produced by hollowing out those portions of the face which are not to touch the cloth. The portion not hollowed out is honeycombed with holes, which are filled with cotton-wool, probably in order that sufficient of the dye may be absorbed. The price of each block generally varies from a few annas to three rupees according to the size and the labour involved in carving them. Those for printing women's *saris* or *sallies* are neatly and tastefully carved, while those for printing *razais*, &c., are generally a little bigger and more rudely cut. In the richer designs where several colours are used each colour has its own block with only so much of the pattern engraved on it as belongs to that colour. For the commoner printing in simply red and black, two dies are kept in each pattern, the one called the *male* used in stamping the black part of the pattern and its counterpart, the *female*, for the corresponding red portion. Some samples of the ordinary patterns in use by the Broach printers, which are characteristic of those obtaining in this Presidency, are forwarded with this report.

In printing, the dyer sits before a sort of desk, about 1½ feet high and 4½ feet long, over which he spreads the cloth to be printed. By his side is the *gadi* or wooden tray, about 2 feet square and 4 inches in depth, containing the colouring solution. In about one-half of this tray are laid three or four folds of gunny or country woollen cloth, which are kept soaked with the required colour, while in the other half is poured some water. When everything is ready, the workman presses the block on the soaked pad of colour and expeditiously stamps the fabric with it. Before, however, recharging the mould with the dye, he first washes off the surplus colour by dipping it in the water kept in the tray, until this has become too discoloured. By long practice the printer acquires great facility in accurately judging by eye the relative distance and position of each impression made with the stamp. As a rule only the coarser kinds of cloth called *khadi* are used in block-printing as they show the prints and colours much better: the lighter and more finished kind of goods printed are generally of European manufacture. Before being stamped the cloth has to undergo the same process of preparation as in cotton dyeing down to the *galling* stage, after which it is allowed to dry for 1 or 1½ hours and then brought home. The pieces of cloth so prepared are in Gujarát called *wagru*.

In order to print the cloth in red and black patterns the subsequent process is as follows. The black colour is generally first applied. This is, as before mentioned, either a preparation of iron liquor obtained by dissolving scrap-iron in water with some fermenting substance such as molasses, or a solution of sulphate of iron (*hirakas*), to which some gum or tamarind seed paste has been added as a thickener. The resulting mark is first greyish, but turns black on exposure to the sun. Next the red part of the pattern is stamped with a solution of alum gum and red chalk or ochre* (*geru*), which is prepared as follows.

* In Khándesh this is described as a red clay obtained from Nagpur.

$\frac{1}{2}$ lb. alum is boiled in $\frac{1}{2}$ lb. of water. This solution is mixed with 16 lbs. of cold water. 1 lb. of gum is dissolved in 1 lb. of alum water, and $\frac{1}{4}$ lb. of red chalk is dissolved in $\frac{1}{2}$ lb. of alum water. These quantities are then mixed with 3 lbs. of alum water. The resulting mixture is sufficient for printing the borders of 20 pieces of cloth. Or, 3 lbs. of alum water, $\frac{1}{2}$ lb. of gum dissolved in $\frac{1}{2}$ lb. of alum water, $\frac{1}{8}$ lb. of red chalk dissolved in $\frac{1}{4}$ lb. of alum water, are mixed together. This quantity is sufficient to print 20 pieces with the exception of the borders. Cloth so prepared is called in Gujarát *thekelu wagra*.

It will be seen that for the red part of the pattern only the mordant alum has really been printed: the colour is applied by subsequent boiling in the red alizarine dye, whereupon the alum pattern turns red, the black remains black but acquires an added brilliancy, and the yellow ground produced by the galling in the *hirda* solution becomes white. The red chalk or ochre (*geru*), which forms part of the alum mixture with which the cloth is stamped, only produces a very faint red, which has little or no effect on the subsequent colour obtained; and it is used simply to define and make the pattern visible to the eye while it is being printed.

The details of the remaining process after the stamping of the cloth are as follows. The *thekelu wagra* is washed in the river and allowed to dry. It is then boiled in a caldron containing red alizarine dye and *dhavdi* flowers for 2 or $2\frac{1}{2}$ hours, as in ordinary cloth-dyeing. It is then taken out, squeezed and dried in the sun. All night it is steeped in an emulsion of sheep's, goats' or camels' dung. The next morning it is taken out, squeezed and washed in river water, if available. It is then kept for 4 days, spread out on a sandy or other convenient place in the sun, being sprinkled over with water from time to time exactly in the way described for ordinary cotton-dyeing. Finally it is washed and dried.

When a ground colour is to be applied to the *sari* or cloth printed, the pattern which has been stamped is always protected by what is technically known as a *resist-paste*. This is generally made of lime and gum and such like sticky substances, and is put into the printing pot and printed over the patterns. In Ahmedabad the mixture required for the resist process is prepared as under:—

40 lbs. of earth.
10 lbs. of lime.
6 lbs. of gum.
1 lb. of *gugal* (i.e., a myrrh-like resin known as Bdellium).
2 lbs. of mowra flowers or of *jagari* are dissolved in about 80 lbs. of water and the mixture is well stirred up.

In Sind the mixture is generally made of a solution consisting of equal quantities of gum arabic and *metori* (a kind of Fuller's earth imported from Sukkur and Zorrick) and twice the quantity of slaked lime, the residue being first strained off. In Surat a similar *resist-paste* is apparently made of castor-oil wax and *khukhan* (the oil extracted from the seeds of the shrub called *Salvadora oleoides*).

Sometimes the patterns are printed with this paste alone, with the effect of leaving them white when the rest of the cloth is dyed. Its drying may be facilitated by sprinkling some sawdust over it; while it can be removed, when desired, by simply steeping the cloth for about two hours in plain water.

The ground-colour may be applied to the cloth by rubbing it on with a piece of flannel, or by the cloth being steeped or boiled in it, as in ordinary cotton-dyeing. Thus in Gujarát when a green ground-colour is desired, the cloth, after the resist-paste has been applied to the pattern, is first dyed in a light solution of indigo and allowed to dry. A solution is then made of old turmeric roots and applied by means of a sponge-like piece of cloth over the *sari*. When the turmeric colour has dried up, the *thekelu wagra* is similarly treated with alum water, and when that has dried up the cloth is washed in the

river. This turns the indigo-dyed part into green. A similar process is followed for producing other compound colours; and simple colours except indigo and alizarine red are generally applied by being rubbed on with a piece of cloth in the same way as turmeric.

When patterns are to be printed in colours other than red and black, these are generally prepared for use by thickening sufficient of the ordinary dye-solution with gum, flour or whey. Patterns in colours other than red and black. Aniline dyes are used for printing by being finely powdered and mixed with water, which is thickened in the usual way to the proper consistency. Native dyes are often mixed with them, e.g., turmeric with green. Sometimes, though rarely, the ground colour is applied before the patterns are printed.

A sample obtained from Sháháda in the Khándesh District, which is forwarded with this report, will serve to show the ordinary style of dyeing and printing a *razai* which obtains through most of this Presidency. The chief defect is the want of definition about the patterns; and although excellent workmanship and finish can be obtained in block-printing, the wood blocks soon lose their sharpness and the effects of depth and light after use. Mr. Tavaría of the Victoria Jubilee Technical Institute, Bombay, suggests that if information on the subject of electro-plating were supplied to those concerned, it would probably lead to an advance or improvement not only in the dyeing industry, but in all those to which the art of wood engraving is supplementary. Electro-plating is now done by natives in the City of Bombay in numerous petty shops, in some of which the work turned out is excellent; and already a fairly large business is done in replating harness brass work, old lamps, candle-sticks, &c. Electro-plating of small wood blocks is not a difficult operation, and, provided rapid results are not aimed at, can well be done with batteries such as electro-platers commonly use. Some experiments in this direction have, I believe, been made by Professor T. K. Gajjar, B.Sc., M.A., late Principal of the "Kala Bhavan," Baroda, at the dye-house, which forms so important a part of that Technical Institute; and the matter is one which deserves attention.

In Sind it is reported that metal dies are also used, but their nature is not described; and sometimes, when a gaudy effect is desired, articles of female apparel and others are painted by hand with aniline dyes thickened with a castor-oil paste. The paint thus obtained is applied to the cloth by a reed-pen or a piece of stick. Other methods in Sind.

(ii) *Silk-printing* proper is only done to a very small extent and no mention of it has been made in any of the reports received from the various districts. In Bombay, however, a silk manufacturing mill has recently introduced printing on silk as a branch industry. Silk handkerchiefs are printed in a large variety of designs, chiefly for the Burmese market. The mill is fitted with modern steam chambers, in which the printed goods are exposed, to allow the colours to "discharge." Engraved brass cylinders and machinery are not, however, utilized for the printing, but the designs are (as in calico-printing) stamped by hand with engraved wooden blocks. It is said that the inevitable change of fashion in printed goods would necessitate the constant replacing of the costly brass cylinders for newer designs, and their introduction would not therefore pay. The workmen are chiefly Mahomedans. Silk *saris* are also printed which are worn in Gujarát and elsewhere. Printing in Bombay Silk Mill.

A commoner form of silk-printing is the process styled 'knot-dyeing' or *bandhani* already alluded to. This style of dyeing closely resembles printing, but is done on a different principle. Indeed it appears to have been first devised to overcome the difficulty met with in the production of white spots on a dark dyed ground. It is largely practised in Gujarát, Cutch, Sind and Bombay, and is scarcely met with in other parts of India. Knot-dyed goods, which are generally handkerchiefs, *saris*, bodices, petticoats, trousers, borders, turbans, &c., are prepared chiefly for consumption among higher class Gujarátis and Pársis. The patterns pro-

duced are either in dotted lines, or in single or grouped spots, the latter varying in size from that of a mustard seed to that of an almond. They are either round or square according to the way of tying the knot. The spots when out of the dye-beck are either white or slightly discoloured. Although large quantities of English goods are manufactured very cheaply in imitation of this style, it is still kept up in Káthiáwár and places like Ahmedabad. The style, however, entails much labour and is very expensive, and there is reason to fear that it is gradually declining.

The people who practise this art are the *Rangrez* (dyers) and the *Bandharas* (tyers). They are either Mahomedans or Hindus. Knot-dyers and tyers. In Káthiáwár they are nearly all *Khatris*, half of whom work as knot-tyers and half as dyers. In Ahmedabad the knotters, besides middle and low class Mussalman and Hindu women, are *Chundigars*, Mussalmans of Hindu origin, a hard-working, sober and thrifty class.

The following is the description of the process in Ahmedabad, given at page 138 of Vol. IV of the Bombay Gazetteer, which is reported to be still as applicable as it was when the information was supplied :—

"To knot silk the undyed cloth is sent to a draughtsman, *Chitarnar*, who divides the whole surface into one inch squares. Then it goes to the knotter, *Bandhnari*, generally a girl, who picks up a little of the cloth at each corner of the square and ties it into a knot, the number and position of these knots or rosettes fixing the character of the pattern. After being knotted, the silk is handed to the dyer, who dips the whole into the colour required for the ground of the pattern. The knots are then unfastened, and the silk that was tied up in the knots shows in little white circles, where sometimes yellow centres are painted in. This is the simplest of the knotted patterns. In others, especially in the flower-garden, *phulvadi*, pattern many colours are used. In printing the flower-garden the parts that are to remain white are knotted and the cloth dyed scarlet. For the fringe some scarlet parts are tied and the rest dyed purple. When the printing is over, the silk goes to the calender, *Bandhara* or *Kundivala*, where it is washed, starched, and damped with water blown in a fine spray from the worker's mouth, beaten by heavy mallets, *kundi*, and folded."

A more detailed account will be found in Dr. Narayan Daji's "Art of Dyeing in Western India" (1873), but the process is not of sufficient importance to necessitate its being reproduced here. It may, however, be noted that the main secret in the knot-tying is to keep the thumb and forefinger nails long, and a practised hand can knot an area of about 3 feet square in the course of 12 hours, though a close pattern will take three times as long. To produce a red spot design on a black ground, the silk after being knotted is steeped three times in cochineal in order that the red dye should penetrate the thread with which the silk is knotted and fix itself on the white spots beneath, and then successively in solutions of indigo, myrobalans and sulphate of iron within some four or five hours, so that the black colour should not penetrate the thread and spoil the colour of the spots. To produce a pattern having a red ground with white spots, all that is required is to dye the knotted silk red with cochineal without letting it penetrate the thread and affect the spots. Besides the flower-garden pattern, others are called respectively after the elephant, peacock and parrot, for each of which the silk is knotted in a particular fashion.

(iii) *Printing on woollens* does not appear to be carried on in this Presidency, and even in England it is only of comparatively recent introduction.

VI.—Leather-dyeing.

This is an industry in which a considerable number of persons are engaged throughout the Presidency; but very few details regarding it have been given in the various reports which have been received. In the census of 1891, leather-dyers are returned as numbering 14,132, exclusive of the large number engaged in tanning, who also dye leather in many places. These are distributed as follows :—

Gujarát (of which 7,669 are from Ahmedabad and Kaira)	...	9,339
Konkan (Kolába and Ratnágiri)	...	20
Deccan (of which 2,906 are from Satára, Sholápur and Ahmednagar)	...	3,359
Karnatak	...	128
Sind (of which 828 are from Hyderabad)	...	1,111
Bombay City	...	175

The castes engaged in this occupation are chiefly low castes, such as *Chambhars*, *Dhors*, &c., like those engaged in tanning. In Broach two factories have been opened during the last four or five years for tanning or preparing hides; but in Ahmednagar the industry is on the wane, as it is understood that the preparation of dyes for dyeing country leather costs as much as dyed English leather. It is said that one *Chambhar* can prepare a pair of shoes worth 14 annas to 1½ rupees in a day, and one *Dhor* a set of harness worth 8 to 10 rupees in 8 or 10 days.

The following are the methods of dyeing leather
Methods of dyeing leather. white, red and yellow as practised in the Ahmednagar District.

(1) *White.*

The skin is first placed for a day in water. The next day it is washed inside with *chunam* and again placed in water for one week. The hair or wool is thus removed, and the skin is again placed for 9 days in a decoction of powdered *Tarwad* (*Cassia auriculata*) bark and water, a fresh mixture being prepared every third day. The skin is then dried and is of a white colour.

(2) *Red.*

The skin is first placed in water for an hour and afterwards for a day in a mixture of salt and a powder made from the leaves of the creeper called *Utaran* (*Dœmia extensa*). The hair is then removed and the skin placed for three days in a boiled mixture of *math* flowers (kidney-bean or *Phascolus aconitifolius*). It is then removed and washed with lac-dye, which is prepared by boiling lac with a small quantity of *lodha* (bark of *Symplocos racemosa*) and *papadkhar*. The skin is then placed for six days in a mixture of *Tarwad* bark powder and afterwards dried.

(3) *Yellow.*

The skin is placed in water for a day and then washed inside with *chunam* and again placed in pure water for 8 days. The hair is then removed, and the skin is placed for 9 days in a mixture of *babul* bark powder and myrobalan powder, a fresh mixture being prepared every third day. When dried, the hide is completely yellow.

A similar process appears from the Bombay Gazetteers to prevail in most districts where leather-dyeing is carried on.

VII.—Wood-dyeing.

This is practised to a considerable extent by wood-turners and makers of wooden toys, chess-men, &c. Thus in Sátara these articles are said to be dyed by *Khatris*, and the same caste often engage in this business elsewhere in the Deccan and in Gujarát. The making of coloured wooden toys is more especially an important industry in the Belgaum and Dhárwar districts. Gokak and Deshmur in the former district are famous for toy-making, which engages some 15 families of the *Jingar* caste, who have forsaken their old craft of leather and saddle making for this and others. They claim to be Kshatriyas and to have come from Kolhápúr a century and a half ago. In Dhárwar *Jingars*, also known by the name of *Rangaris* and *Chitragars*, follow the same profession, but the toys made are said to be inferior to the Gokak ones. The wooden articles made and dyed are chiefly cradles, palanquins, toys, fruit, animals, men and gods. The boys help the men in preparing the colours. In turnery, the colour is made up into a stick, similar to sealing wax, with the aid of lac, resin, sulphur and bees'-wax, and is applied to the wood whilst it is turning in the lathe, the heat engendered by the friction being sufficient to melt the end of the stick of coloured wax. The colour thus applied is probably faster than ordinary paint, although it cracks and peels off in the sunshine. A final polish may be given by rubbing the wood with a leaf of the *keeda* (*Pandanus odoratissimus*). The material generally used for colouring red is vermilion; for colouring yellow, orpiment; for colouring green, verdigris or a mixture of orpiment and indigo; for colouring blue, indigo or the English Prussian blue; and for colouring black, lamp black.

The toys in Belgaum and Dhárwár are coloured with the following dyes :—

(1) *Red.*

In Belgaum this is prepared by the dissolution of red arsenic (Ingalic) in gum water. In Dhárwár vermilion powder is mixed with gum water or varnish. To make the dye fast in the former case, the wood must be varnished after being coloured. A rose colour (*gulabi*) is obtained by the mixture of red arsenic with white lead in the proportion of 1 to 8 parts ; and in Dhárwár a pale red shade called *chandra* is produced by mixing minium or red lead with gum water.

(2) *Yellow.*

This is generally prepared from orpiment. In Dhárwár a *soneri* or golden colour, which is rather a troublesome dye to prepare, though very beautiful and lasting, is obtained by dyeing the wood with pounded and melted tin, then rubbing the part dyed with a cloth, and finally applying an oil called *gunna* oil over the same part once a day for three days. The *gunna* oil is prepared by the *Chitragars* themselves from *chandras* gum (? *rajan*, *Mimusops hexandra*) *karchola* or black *moka* aloes, and linseed oil.

(3) *Blue.*

A substance brought from Bombay, probably English Prussian blue, is stated to be used, being mixed with gum water or varnish. A lighter shade called *mani* is procured by mixing this with white lead (*sappati*). Indigo would also appear to be used.

(4) *Black.*

This is obtained by mixing the powder of the burnt shell of a cocoanut or lamp-soot with gum water.

(5) *Purple.*

This is made by mixing the blue dye with the red.

(6) *Green.*

This is prepared in Belgaum by a mixture of indigo with a yellow powder called *pivadi* in the proportion of 1 to 8 parts. In Dhárwár a colouring matter brought from Bombay and mixed with gum water or varnish is used.

(7) *White.*

This is merely white lead *sappati*, which when mixed with water forms a perfect white colour.

All these mixtures require thorough grounding and rubbing before use for dyeing purposes ; and the articles are carefully rubbed with chalk and polished before they are dyed.

APPENDIX I.

Table of Statistics compiled from the Census Returns of 1891 showing the number of persons engaged in Dyeing, &c., in each District of the Bombay Presidency.

Serial Number.	Name of District	Cotton dyers.	Cotton calenders, fullers and printers.	Silk printers and dyers.	Wool-dyers.	Leather-dyers.	Total.
	<i>Gujarat.</i>	10,515	1,121	608	61	9,339	24,914
1	Ahmedabad ...	5,000	4,108	289	54	1,042	13,4
2	Kaira ...	3,016	6	12	...	3,627	6,6
3	Panch Mahals ...	127	...	...	...	136	2
4	Broach ...	545	307	...	...	568	1,4
5	Surat ...	1,827	...	327	7	966	3,1
	<i>Konkan.</i>	513	0	0	0	20	533
6	Thana ...	334	...	...	...	...	3
7	Kolaba ...	70	...	...	...	6	
8	Ratnagiri ...	52	...	...	...	...
9	Kannia ...	57	...	...	...	14	
	<i>Deccan.</i>	6,316	363	69	32	3,359	10,169
10	Khandesh ...	2,923	148	9	24	24	3,1
11	Nasik ...	813	186	42	...	275	1,31
12	Ahmednagar ...	436	...	...	...	620	1,1
13	Poona ...	607	4	...	...	154	76
14	Sholapur ...	1,238	14	...	...	688	1,9
15	Satara ...	269	11	18	8	1,589	1,89
	<i>Karnatak.</i>	4,159	39	192	0	128	4,818
16	Belgaum ...	1,464	38	354	...	4	1,86
17	Dharwar ...	1,074	1	...	...	10	1,^
18	Bijapur ...	1,621	...	138	...	114	1,87
	<i>Sind.</i>	12,850	88	138	0	1,111	14,187
19	Karachi ...	2,579	16	44	...	26	2,66
20	Hyderabad ...	6,278	12	51	...	828	7,16
21	Shikarpur ...	2,512	51	41	...	67	2,6
22	Thar and Parkar ...	1,156	8	1	...	4184	1,34
23	Upper Sind Frontier ...	325	1	1	...	6	32
24	Bombay City ...	3,553	186	46	0	175	3,960
	Total ...	37,936	5,037	1,353	93	14,132	58,61

APPENDIX II.

Statement showing the areas in acres under Indigo, Al, Kasumba and Turmeric in each District of the Bombay Presidency including Sind for the years 1890-91 to 1894-95.

No.	District.	Indigo (Indigotera Tinctoria.)					Al (Normda.)					Kasumba (Cassiaum Persiens.)					Turmeric (Curcuma longa.)					Remarks.
		1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	

Turmeric, which is largely used as spices in native cookery, is shown under spices and not under dye in Hope's Manual. It is difficult to say to what extent the stuff is utilized as a dye, this depending mainly on the intention of the cultivator.